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THE JOURNAL OF
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Volume 41 March, 1950 Number 3

PHYSICAL MATURING AMONG BOYS AS RELATED TO BEHAVIOR

MARY COVER JONES and NANCY BAYLEY
University of California

The problems of adjustment which are usually attributed to the adolescent period center around the youth's need to develop heterosexual interests, to select a vocation, and, in general, to acquire the status of adulthood in the eyes of his peers and of his elders. The impetus for the attainment of independent and mature status is undoubtedly related to the adolescent's physical changes, but the process of growing up is so complex and so interwoven with cultural factors that we have not yet been able to demonstrate more than a rather general relationship between physical and psychological phases of development.

It is well known that children mature at different rates, and reach the period of pubescence at different chronological ages. Although the psychological accompaniments of these differences in maturing can be examined in terms of mass statistics,[19,20] this approach to the problem is often disappointing because of its tendency to obscure the intricacies of the growth pattern and the dynamics involved in the process of integration. Case reports of individual children have been somewhat more successful in their attempts to disclose the processes involved in the attainment of maturity,[11,13] but the accumulation of individual life histories is a slow way in which to arrive at useful generalities.

The present report deals with two groups of boys who fall at opposite ends of a normal sample distributed on the basis of one developmental characteristic (skeletal age). In an attempt to find differentiating behavior characteristics, statistical comparisons of the two groups have been made and illustrative case material has been assembled for individuals falling at each extreme. The method, while providing no touchstone, does

enable us to consider group differences* without losing sight of the individual behavior patterns of members of the group.

There are several ways in which children's physical maturity status may be expressed. One of the most commonly used for girls, is the age of menarche. As a possibly comparable measure for boys, some investigators have used the age of appearance of pubic or of axillary hair.[15] Shuttleworth[17] classified children in the Harvard Growth Study according to age at maximum growth in height. Height and weight have also been used as an index of physical maturity, although maturity differences may be obscured by genetic differences in measurements of gross body dimensions. This difficulty is avoided by the use of skeletal age norms, from x-rays of the long bones of the hand and knee.[21,22] Skeletal age has the advantage of being a stable and reliably assessed indicator of physical maturity, closely related to other aspects of physical maturing,[8] and applicable at all ages from birth to young adulthood.

Several studies have dealt with the relationship between skeletal maturity and intelligence.[1,18,24] Comparisons with other psychological factors are relatively scarce. In one of the few investigations in this field, Stone and Barker,[20] using the age at menarche as a criterion, found greater maturity of interests among girls who were past the menarche, than among premenarcheal girls of the same age.

1. PHYSICAL CHARACTERISTICS OF THE EARLY- AND LATE-MATURING GROUPS

The selection of contrasting extreme groups for the present study was on the basis of physical maturity assessments by the Todd standards for hand and knee. The groups included sixteen boys who were most consistently accelerated and sixteen who were most consistently retarded during the four and a half years for which we had cumulative skeletal x-rays, beginning at an average age of fourteen years. The total distribution from which these extremes were truncated consisted of ninety cases, a normal classroom sample of boys in an urban public school system.[13]

Figure 1 presents the comparative maturity assessments of

* The significance of differences is reported for a given age, based on *t* ratios (Table I); and also for the seriatim data, based on the binomial test of significance (sections 2 and 5).

the two groups at two age levels; each dot or circle indicates the skeletal age for an individual case. Some relevant physical data are given in Figure 2, which compares the distribution of the two groups in height at three age levels, and also with regard to adult height as predicted by the Bayley method.[3,5] The age levels used are grade placements (instead of more restricted

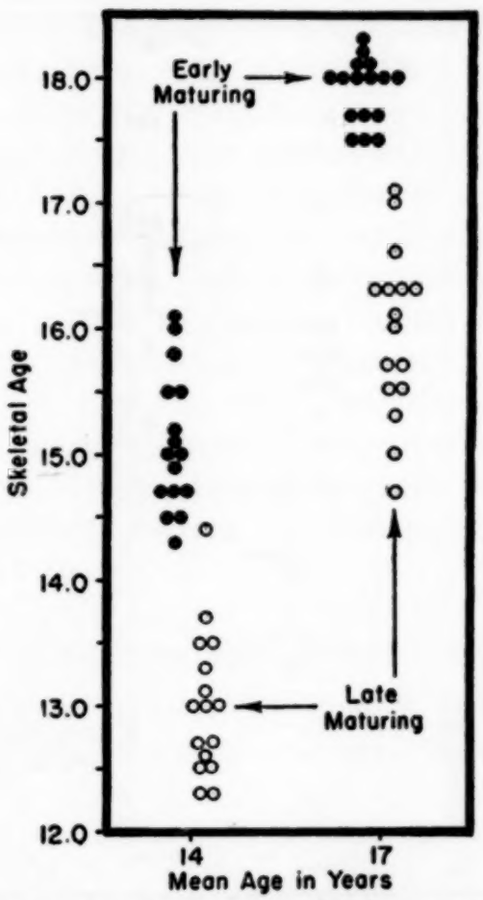

Fig. 1. Skeletal Maturity Assessments of Early- and Late-maturing Individuals, at Ages 14 and 17.

age intervals) to facilitate comparison with the behavioral data which are of greater significance when kept in their original contexts.

On the average, the physically accelerated and the physically retarded boys are seen to be of the same age, but are separated by about two years in skeletal age (the criterion variable). Although some overlapping can be noted (Fig. 2) in the height of individual children at each age, the means of the groups (indicated by arrows) are widely different. Even as early as eleven years

(grade H5 and L6) all of the late-maturing are shorter than the mean for the early-maturing. At the mean age of fourteen years (grade H8 and L9) the distributions show an extreme separation; in the later years of adolescence the differences tend to decrease, and the predicted mature heights of the early- and late-maturing are very similar.

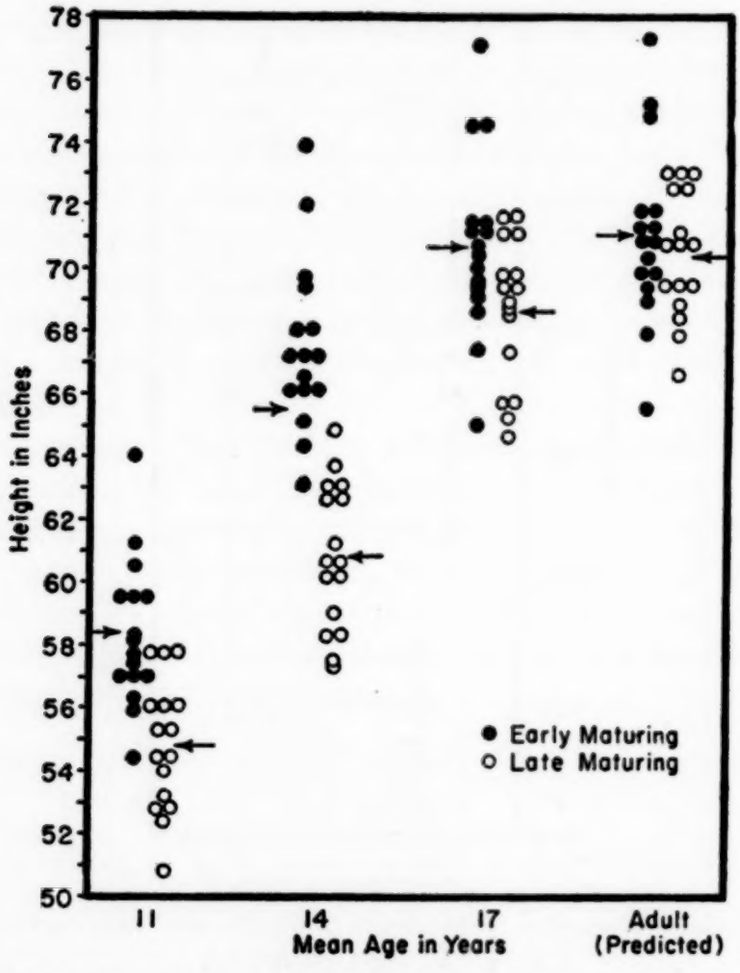

Fig. 2. Height Measurements of Early- and Late-maturing Individuals, at Four Ages.

There is also an obvious divergence (with no overlap) when the two groups are compared in terms of physical maturity ratings. This is seen when Greulich's five-point standards of maturity* are applied to photographs taken at fourteen years of age. The characteristic rating at this age is 3. The mean of sixteen early-maturing boys was 4.5 (close to the maximum), with no rating

* Based on ratings of pubic hair and external genitals.[9]

below 4. The mean of the sixteen late-maturers was 2.0, with only two ratings of 3.

The boys who matured late were relatively very small from thirteen to fifteen years. In agreement with Bayley's[2] study of body build in relation to skeletal maturing, they were characteristically slender built and long legged at all ages. Furthermore, their strength tests show them to have been relatively weak at the ages when they were lagging in size, and their scores in the Espenschade tests of athletic ability[6] were in most instances below average. The early-maturing boys, on the other hand, were usually large, broad-built and strong, and tended to show good athletic skill throughout the period of our records. Their superiority in strength and physical skills was greatest at ages thirteen to fifteen,[12] when their early growth spurt accentuated their differences in size as compared with the slower-growing average and late-maturing boys. This is in agreement with a recent report by H. E. Jones, who presents a variety of data for groups of boys in the Adolescent Growth Study, considered in relation to static dynamometric strength. Strong boys were found to be relatively mature in skeletal age, weak boys were immature.[13]

2. SOCIAL BEHAVIOR IN BOYS' GROUPS

The psychological records examined in connection with the present study include both observational measures and reputation scores. We shall present first the ratings made independently by three staff members when the boys were in small groups (usually six) in a same-sex 'free play' situation. These will be referred to as ICW (Institute of Child Welfare) ratings.* The observations and ratings were concerned, in general, with social behavior and personal attributes which are important in social relationships.

The ratings have been converted into standard scores in which 50 represents the mean of the total group, with an SD of ten points. The direction and the degree of a child's deviation from the mean of his group are thus expressed in such a way that comparisons can readily be made between accelerated and retarded subgroups.

---

* Reference 14 contains a description of the rating scales and procedure.

Figure 3 and Figures 5–7 present cumulative standard score curves, from ages* twelve to seventeen, for a series of traits involving personal appearance, expressiveness, attention-seeking, and emotional patterns. As shown in Figure 3, the early-maturing are consistently rated as superior in physical attractiveness, with average scores which reach their highest value at age fifteen. In general, the group is about one SD above the

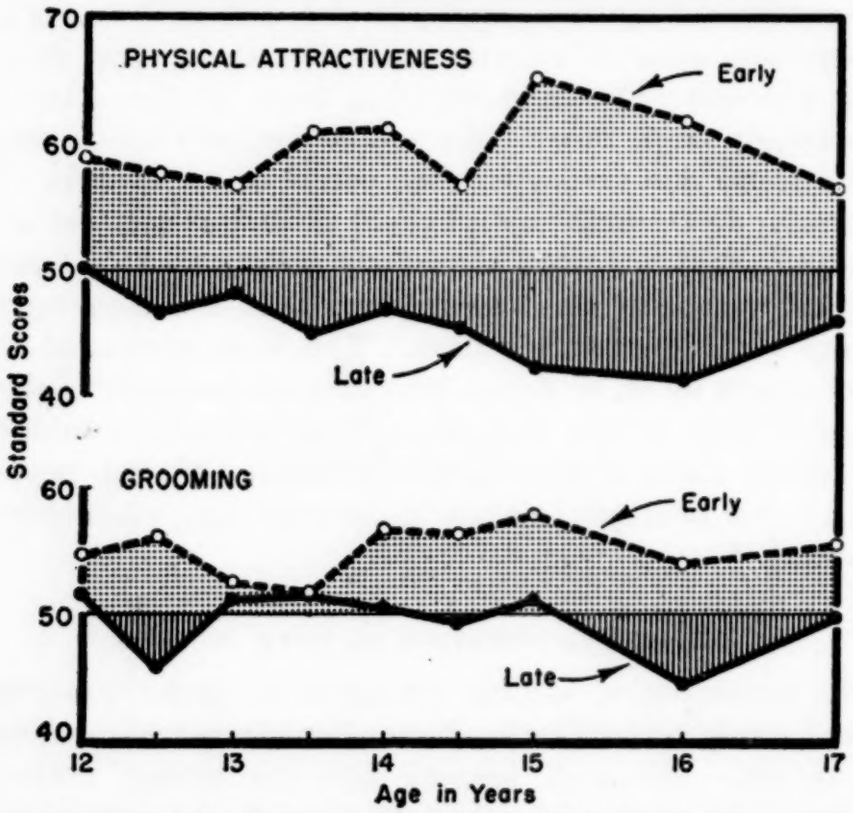

Fig. 3. Mean Standard Scores for Early- and Late-maturing groups, in Physical Appearance.

mean total sample of boys. The late-maturing fall somewhat below the group mean, increasingly so from age twelve to age fifteen or sixteen. These differences in attractiveness of physique are complexly influenced by factors of size and of body build. Early maturing is not only associated with a more rapid growth in height, but also with mesomorphy.[16] The boys in this group tend to be 'well-built,' muscular, and athletic.† By contrast,

* The average ages are approximate, the groups at each age being based on a grade selection.

† By Sheldon's classification,[16] the average body-build formula was 2.8 − 4.4 − 3.5 for the early-maturing; 2.4 − 3.9 − 4.0, for the late-maturing.

the more slender, poorly-muscled build of the late-maturers was rated as relatively 'unattractive' by the adult observers.

When a comparison is made of the androgynic qualities of the builds of these two groups, the early-maturers are found to be on the average more 'masculine,' the late-maturers more 'childish' in their build.* As shown in the lower half of Figure 3, early-maturing, as might be expected, is also associated with a somewhat greater attention to the amenities of personal grooming. This is expressed in cleanliness, attention to hair and nails, and neatness of clothing.

The difference between the two groups in physical attractiveness is most marked at ages fifteen and sixteen. Figure 4 pre-

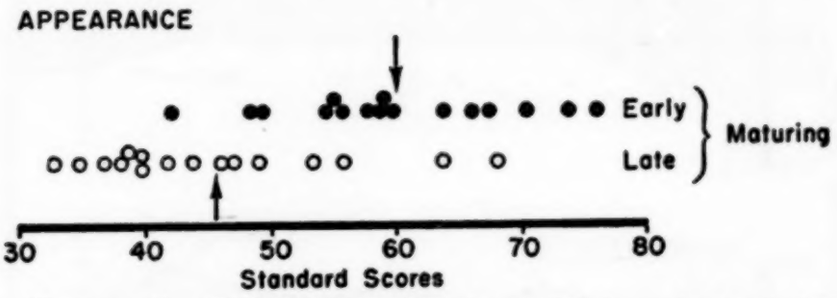

Fig. 4. Comparative Distributions of Early- and Late-maturing in 'Appearance' (means indicated by arrows).

sents comparative distributions at age sixteen for a composite based on physique, grooming, and attractiveness of facial appearance. Each circle represents an individual case; the means are indicated by arrows. So marked is the separation of the early- and late-maturing that all but one of the former fall above the average of the latter; only two cases among the late-maturing are rated above the central tendency of our total group of boys.

Another group of traits which may have developmental significance are those related to expressiveness. Ratings of 'animation' and 'eagerness' are presented in Figure 5. In these characteristics the early-maturing are close to the group average, but the late-maturing are consistently above the average. Similar differences were found for other traits involving expressive-

* The androgyny ratings were made independently, for another study.[4] 'Asexual' ratings (deficiency in masculine development) were much more common among the late-maturing, occurring in ten cases of this group as compared with only two cases in the early-maturing. Constitutional, and not merely maturational, factors are involved in these androgynic differences.

ness; comparisons were made for behavior defined, at contrasting extremes, as talkative-silent; active-stationary; busy-idle; peppy-indifferent; and laughing-sober. In each of these the early-maturing boys were distributed similarly to the total sample of boys, the late-maturing were consistently on the 'expressive' side of the scale.

At least two factors are probably involved in determining this deviate position of the late-maturing. The first is a per-

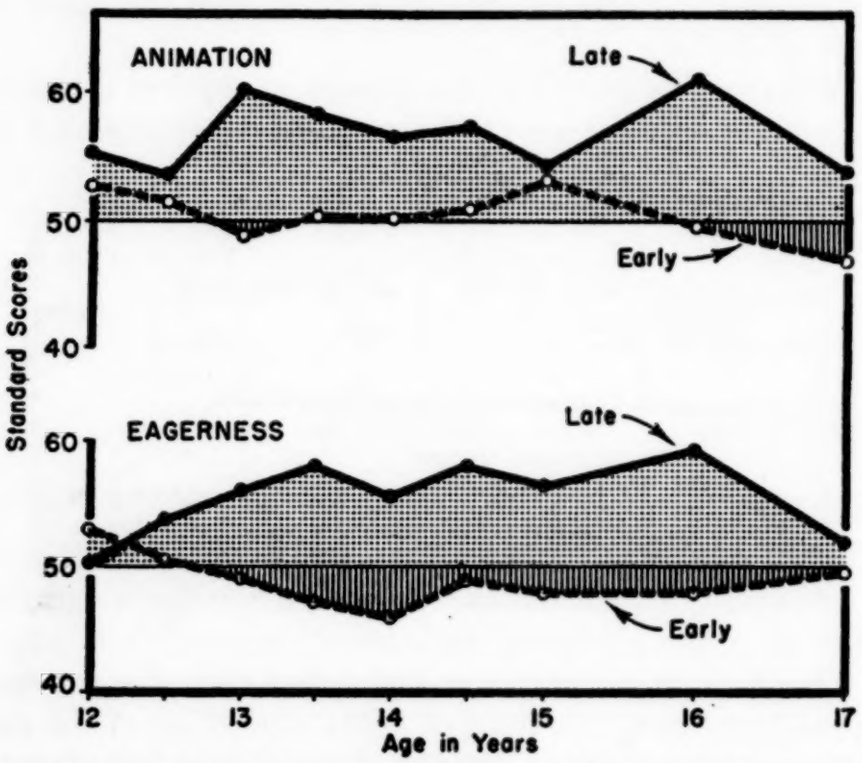

Fig. 5. Mean Standard Scores for Early- and Late-maturing groups, in Expressive Traits.

sistence of a childish activity pattern. A busy scurrying about and noisy interchange of shouts and comments is more characteristic of pre-adolescence than of later years; the adolescent often looks down upon such behavior as undignified, and adopts instead the rôle of a lounger, observing with tolerant superiority the childish antics of those younger than himself. A second factor is a reaction formation to inferiority. The 'active small boy' may be expressing through his activity not merely a survival of an immature culture pattern, but may also use this, as the only technique he knows, to hold the attention of others and to compensate for a physically less favored status.

In this connection, it is instructive to consider the evidence concerning attention-seeking behavior, as presented in Figure 6. In the upper half of this figure, the late-maturing boys tend to vary around the average in the trait 'matter-of-factness.' Their lowest score is at age sixteen, when they fall on the 'show-off' side of the scale. In the lower half of the figure, their scores also vary around the average on the trait 'unaffectedness.' Again, they attain a low score at age sixteen; their expressiveness is

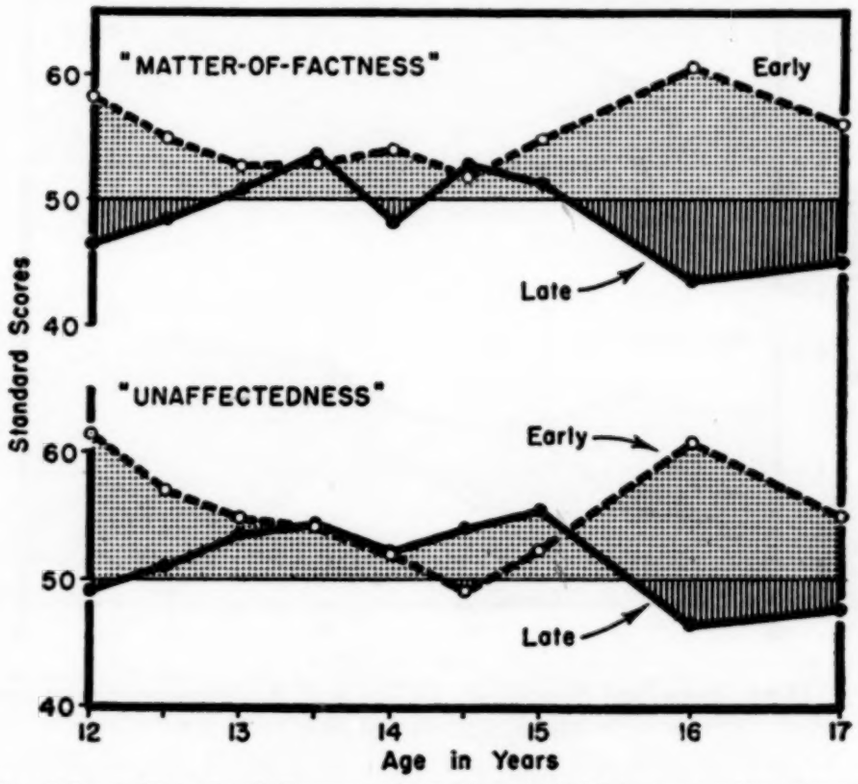

Fig. 6. Mean Standard Scores of Early- and Late-maturing groups, in Attention-seeking Behavior.

judged to have a more affected quality at ages sixteen and seventeen than in the years immediately preceding. Although the differences are small, this would be consistent with an interpretation emphasizing a 'natural' or 'childish' expressiveness in the earlier years of adolescence, and a more compensatory attention-seeking expressiveness in the later years. In contrast, the early-maturing are at these ages judged to be relatively non-attention-seeking: unaffected and matter-of-fact.

Also pertinent are the ratings for inhibition and relaxation in social situations (Figure 7). The late-maturing are relatively

uninhibited, but they are also judged to be relatively tense. At age sixteen, the early-maturing are on the average approximately one SD above the group mean, in the direction of 'relaxation,' and the late-maturing are a similar distance below the mean, in the direction of 'tenseness.' The early-maturing are consistently well-adjusted in this trait, while the late maturing are in most semesters on the less well-adjusted side of the scale.

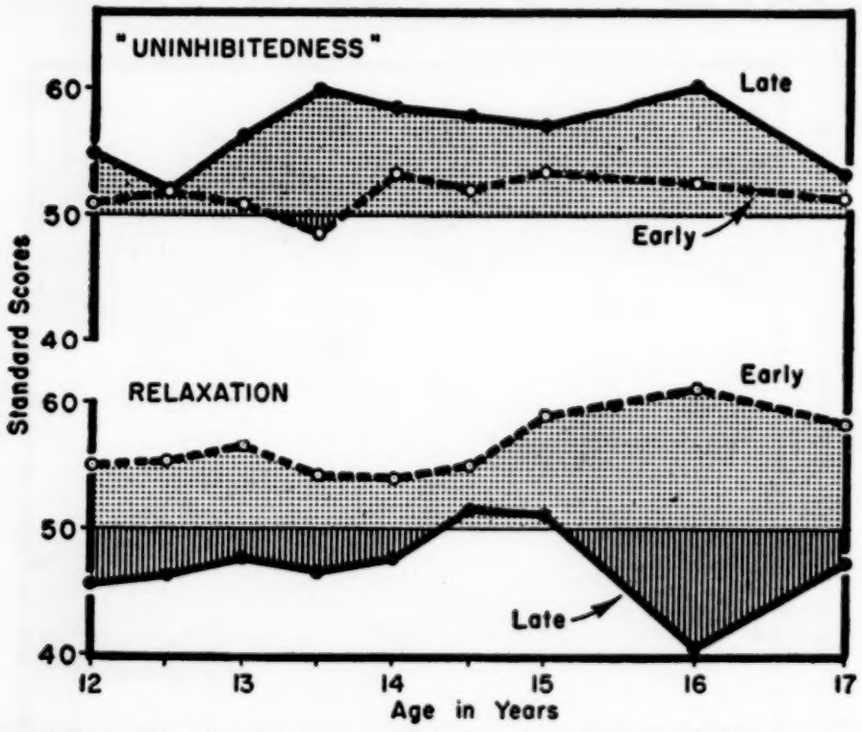

Fig. 7. Mean Standard Scores of Early- and Late-maturing groups, in Emotional Patterning.

Table I presents the significance of the differences between the early- and late-maturing at age sixteen, based on *t* ratios. For all but two traits on this list, differences are significant at the five per cent level or better. In these two traits (animation and 'uninhibitedness') significant differences are obtained when results are considered for all nine semesters in which ratings have been recorded, from ages twelve to seventeen, and analyzed in terms of the binomial test for consistency.* In attractiveness of

* Based on the probability that the difference in a series of paired measures will occur in the same direction in a specified proportion of the instances.[7] Since the same subjects are involved, consistent differences are interpreted as independent of errors in measurement, but they are not necessarily independent of initial sampling errors.

physique, grooming, and relaxation (higher for the late-maturing) differences are in the same direction in each of nine semesters, with a significance level of .002. Differences of the same consistency were obtained for a number of other traits not included in Figures 3–7; these results show that the late-maturing are significantly more busy, more active, more 'peppy,' and more talkative. Differences at the two per cent level (in the same direction for eight of the nine semesters) were found for eagerness, social initiative, and sociability, in favor of the late-maturing. Differences at the seven per cent level (in the same direction

TABLE I.—MEAN STANDARD SCORES FOR EARLY- AND LATE-MATURING

	Early	Late	Significance of Difference
Attractiveness of physique	60.6	45.0	.01
Grooming	54.6	49.8	.05
Animation	49.6	61.2	
Eagerness	47.9	59.3	.05
Uninhibitedness	52.5	60.2	
Matter-of-factness	60.5	43.6	.02
Unaffectedness	60.7	46.2	.05
Relaxation	61.1	40.6	.01

for seven of the nine semesters) occurred in several additional traits, indicating a possibly greater tendency for the early-maturing to be good-natured, and for the late-maturing to be attention-seeking and to enjoy games.

It may be noted that the two maturational groups show similar rather than different records in a number of traits of social importance. Thus, they present no marked nor consistent differences in observed popularity, leadership, prestige, poise, assurance, cheerfulness, or social effect on the group.*

In view of the relation of maturing to physical abilities, and of the high valuation placed upon athletic performance in the

* As previously noted, the measures reported up to this point are based on behavior among small groups of boys. Somewhat greater prestige differences are apparent, especially in the later years, when measures refer to behavior in mixed groups, or to reputation scores based on votes from both boys and girls (considered in a later section).

adolescent culture,[23] it is perhaps surprising that differences in maturing are not reflected in such traits as popularity, leadership, or prestige. Case reports[11,13] have made it clear that late-maturing is sometimes a primary source of social and personal maladjustment. On the average, however, the late-maturing boy succeeds in maintaining a fairly adequate status among his age-mates; very likely he is helped in this by his activity and other compensations, and it is also probable that some of the early-maturing are handicapped at times by the fact that they have outgrown their age group.

3. DESCRIPTIVE DATA

In Figure 8, which presents unweighted composite values for various aspects of expressiveness* at age sixteen, it can be observed that six of the late-maturing boys fall quite outside the

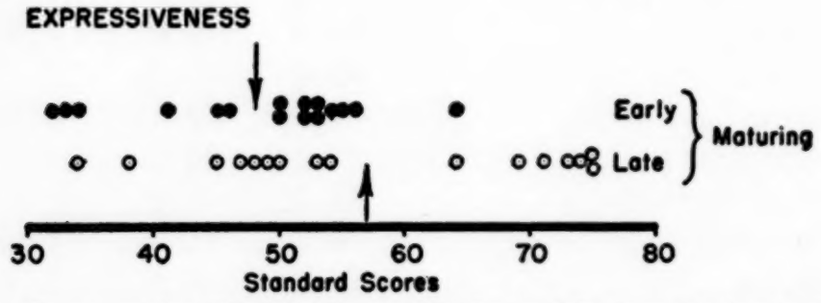

Fig. 8. Comparative Distributions of Early- and Late-maturing in Expressiveness (means indicated by arrows).

distribution of the early-maturing. A brief description of each of these individuals will provide a more concrete indication of a behavior pattern characteristic of nearly half of the physiologically retarded boys. This pattern of 'boyishness' is fairly well illustrated by the case of Tom:

> As a junior high school 'preadolescent' Tom was a chubby small boy, very rosy of cheek, sparkling-eyed, laughing and dimpled. His gaiety, good humor and dynamic activity were effective among his own equally boyish friends though most of his age-mates considered him to be quite immature in behavior.
>
> Staff members made the following brief notations on the comment sheets recorded during free play situations (ages indicated in parentheses):

---

* The component variables are talkative—silent; active—stationary; peppy—indifferent; busy—idle; animated—stolid; eager—listless.

(13.4) In the nursery school yard: He seemed as delighted with the children of the nursery school as though someone had handed him a litter of puppies.

(13.4) At 'free' play with his own group: Tom played baseball with spirit if not with great skill. His activity was accompanied with continuous good-natured comments about the progress of the game and the 'boners' of his team-mates.

(13.9) Talking to another classmate: Tom Saylor chattered to Jim Cohn about his new job with as much enthusiasm as if he had found a gold mine. He is paid fifty cents a week to pass out handbills for a grocery store; this involves getting up at 5:30 every Friday morning. He was enthusiastic in urging Jim to "get in on it." The latter's indifference seemed to him like mild insanity.

(16.4) In senior high school: Still a small boy in comparison with most of his classmates, Tom's immaturity was obvious in many ways. His face was still cherubic, his lively and uninhibited activity more typical of younger boys. In the tenth grade an observer wrote: "He would seem to fit better in a junior high than a senior high school setting. Put him in a seventh or eighth grade classroom, and his appearance and behavior would be quite in keeping with that of the majority of his classmates."

Tom's clothes were misfits but he was as unconcerned about this as about his very dirty hands, although by this time most high school students were paying attention to clothes and cleanliness. His voice had not changed, as was very evident when he used it argumentatively in card games or jocularly in good humored razzing.

On the playground: Tom played pitching pennies with Ralph (an early-maturing boy) and seemed much more emotionally involved than the latter. He is often a conspicuous figure in childish scuffles; during a friendly tussle with several other boys, he was disturbed at finding that he had lost his penny. He was ready to cry and fight about this, the only coin he had.

During most of this period (junior and senior high school) Tom seemed not to suffer from introspective misgivings about his adequacy. By some magical formula, he apparently had caught and prolonged that legendary will-of-the-wisp, 'happy childhood.' Tom seemed oblivious to the tide of events which swept most of his classmates into an earlier puberty. But his euphoric and carefree attitudes were not shown to an equal degree by all of the other six late-maturing who were also classified as exceptionally 'expressive.' Among these with relatively similar patterns of conspicuous and active behavior were several boys who seemed more obviously to be compensating for a sense of physical inadequacy or for loss of a social prestige which they had enjoyed in earlier years:

Lonnie was a boy previously described by H. E. Jones[13] as one whose physical deficiencies in size and athletic prowess were a persistent source of tension and anxiety. His activity pattern was accompanied by excessive verbalizations and became more aggressive and compulsive as his status with the group declined and his home situation failed to support him during this difficult period.

Neal, another late-maturer, possessed a well-knit, athletic build, but was too small to play football or basketball on the team, as he had always been too small to compete with an older brother. His activity was chiefly limited to using athletic equipment; with other boys in a playground situation, he was inclined to be surly and on the defensive.

Bill and Teddy, two good friends from the same neighborhood, were active as nursery school children are active—they climbed, chased each other, hid and ran about. Often they were the ring leaders in mischievous hiding of the clothing or books belonging to other boys.

Milton was described as agile and quick, "climbed around like a monkey," " . . . his energy output seems to be twice that of an average healthy boy," he 'horsed around' in mixed group situations. In much of his group play he seemed to invite attack, to enjoy being teased and pummelled. At one time, however, he paid a mature classmate ten cents a week to protect him from some boys who were pestering him. An undisciplined child of somewhat elderly parents, he was disorganized, often rebellious, spent his energy in emotional outbursts as well as in random activity.

The six most 'expressive' late-maturing boys were conspicuous because of their activity in situations involving small groups of boys. They had chosen or were forced into what appeared, superficially at least, to be similar patterns of behavior. Yet the factors which determined the broad aspects of this behavior pattern were diverse and complex, altering in essential ways the details of the pattern from individual to individual.

Although expressiveness as exemplified by talkativeness, activity, eagerness and 'pep' is a form of behavior which many late-maturing boys easily assume or toward which they are predisposed, examples can be found of a quite opposite tendency. Two of the late-maturing boys are to be found near the extreme low end of the scale in expressiveness. These boys are brothers—Glenn and Charles. They were extremely self-contained and quiet, finding within themselves and their family satisfactions in behavior which did not require an audience or group participation.

Both boys were rated as non-attention getting and matter-of-fact; they were unsocial, and judged to have little effect upon their group of contemporaries. When most youngsters were seeking social satisfactions outside the family, Glenn and Charles were still enjoying congenial recreational interests with their parents. Their summer vacation was a family camping trip which involved packing into lonely country where the fishing and hunting was good. Glenn's response to the question, "Does your mother go camping with you?" was, "Yes, she likes to get away from people, too."

While in some respects Glenn and Charles resembled the early-maturing boys, their total complex of traits would never have led an observer to judge them to be among the more grown-up. In addition to having the lowest scores among late-maturers on 'expressiveness,' these brothers also had the lowest scores for 'sociability.' It is rather to be expected that girls

would be outside their world. It was not until after they entered college that they began to take any initiative about dating girls. The mother, concerned with their 'backwardness' in this respect, tried to arrange for visits from families with girls of an appropriate age. After one such evening she was taken to task by her boys in this fashion: "Don't ever try that again. We didn't know what to talk about and it was a terrible bore."

Glenn and Charles are two boys who were late in reaching physiological and skeletal maturity and similarly slow to take on the social behavior of their peers. But in their slowness they remained aloof, bolstered by solid but solitary interests rather than by the energetic outgoing patterns of activity more common among the late-maturing boys of the study.

It is obvious that a statistical average which includes the social behavior scores of boys as different as Tom and the brothers—Glenn and Charles—will provide little understanding of the varieties of adjustment patterns adopted by late-maturing boys.

In analyzing the rating scores of the early-maturers, we find no clear-cut subgroup, such as our half dozen of conspicuously active little-boy late-maturers. This may be because the more grown-up boys are not required to over-react to an inadequate physical status and therefore have not tended to develop any one typical pattern in relation to this factor.

4. CLUBHOUSE RECORDS

Ratings and observations made in mixed group situations provide additional material for comparison of these two extreme groups of boys. These records were made in a variety of social situations, primarily in a clubhouse[10] maintained by the Adolescent Study near the school playground. In this situation it was possible to observe and rate a youngster's 'interest in the opposite sex,' based on approved behavior, participation in dancing and other mixed social situations, and talking about the other sex. As might be expected, marked differences were observed in this trait: in each of six series of records, beginning at age 13.5, the early-maturing obtained average scores above the group mean, and the late-maturing were consistently below the group mean. In this as well as in attention-seeking and other expressive behavior, a tendency could be noted for the late-maturers to show their widest deviation from the early-maturers during the period when they were most different in physical respects; in senior high school the apparent differences diminished, but as

will be seen in the subsequent discussion of reputation records, the development of a more mature pattern, in the late-maturers, does not necessarily imply a prompt change in their status in the peer culture.

The narrative records obtained in the clubhouse situation provide evidence of the numerous specific ways in which maturity differences are expressed. At a Saturday graduation party three of the early-maturers came to the party conspicuously late, a mark of sophistication not shown by any of the late-maturers. Three others had Saturday jobs, had been working all day and were eager to talk to adults about their work. Among the observer's comments about the early-maturers were such notations as 'he dances well'; 'seems to think of himself as an adult'; 'acts a bit condescending'; 'reserved, little energy output'; 'Ran sat in the corner and flirted with Myra'; 'cheek-to-cheek dancing'; 'gay and assured, tried to cut in.'

In contrast, these phrases described some of the boys who were of the same age but were late-maturing: 'the first time I've ever seen him with a girl'; 'he held his head tensely while dancing'; 'didn't dance at all'; 'acted extremely silly'; 'Ronnie admitted he had been to only three dances before'; 'Claude showed a beaming countenance at all times'; 'began to wiggle and giggle.'

5. REPUTATION WITH CLASSMATES

Another source of evidence concerning adolescent behavior and status is from the Reputation Test. For the same age range represented in Figures 3–7, data are available from a series of tests in which classmates were asked to write down the name of anyone in the class conforming to certain descriptions.[23] For example, "Here is someone who finds it hard to sit still in class," or at the other extreme, "Here is someone who can work quietly without moving around in his seat." Scores were obtained by determining the percentage of times a person was mentioned on a given trait description, and these measures were then transformed into standard scores in which 50 represented the 'indifference point' (indicating no mentions at either extreme of the trait). Reputation scores are less differentiating than ratings; they tend to identify outstanding individuals, but may fail to distribute the middle range of cases who receive few or no mentions from their classmates. As a result differences between

early- and late-maturing in average reputation scores are less marked than in average ratings by adults. However, a number of traits show differences which occur in the same direction on six testings, and are significant by the binomial test.

The late-maturing are consistently more 'attention-getting,' more 'restless,' more 'assured in class,' more 'talkative,' less 'grown-up,' and less likely to have older friends. On five out of six tests they are more 'bossy,' and less 'good-looking.'

Less consistency is found for traits which have been established as especially important for adolescent prestige. On judgments of

TABLE II.—MEAN STANDARD SCORES FOR REPUTATION TRAITS

	Early-maturing	Late-maturing
Attention-getting	48.1	52.2
Restlessness	45.3	52.9
Talkativeness	47.9	53.0
Bossiness	47.1	52.6
Assurance in class	45.6	50.0
Popularity	54.0	50.7
Leadership	51.3	47.5
Humor (about self)	53.5	48.7
Having older friends	56.2	42.3
Good appearance	54.4	49.3

'popular,' 'leader,' 'friendly,' 'daring,' 'active in games,' and 'humor about self,' the late-maturing stand relatively well until the middle period of junior high school, and then tend to drop to lower status.

Table II presents a comparison of average standard scores for the two groups in the H 10 and L 11 grades. The differences are not statistically significant but they present a picture which is in general similar to that already found in the observations by adults: the late-maturing appear as assertive (in a small-boy extroverted way) but at this age are somewhat lower in prestige traits.

At the earlier ages the more active and energetic of those in the late-maturing group were not unsuccessful in winning social recognition. But the early-maturing were much more likely to get and maintain the kind of prestige accorded to athletes and

officeholders. Two of the sixteen early-maturing boys became student body presidents, one was president of the boys' club (a position next in importance to that of student body president), several were elected to committee chairmanships, and four attained outstanding reputations as athletes. The sixteen late-maturing boys produced only one somewhat 'important' officeholder (a class vice-president), and one athlete.

6. CONCLUSIONS

A general picture emerges from the various ratings and characterizations of these two contrasting groups of boys. Those who are physically accelerated are usually accepted and treated by adults and other children as more mature. They appear to have relatively little need to strive for status. From their ranks come the outstanding student body leaders in senior high school. In contrast, the physically retarded boys exhibit many forms of relatively immature behavior: this may be in part because others tend to treat them as the little boys they appear to be. Furthermore, a fair proportion of these boys give evidence of needing to counteract their physical disadvantage in some way—usually by greater activity and striving for attention, although in some cases by withdrawal.

In interpreting the relationships reported above, it must be borne in mind that we have used somewhat imperfect tools, and that a more complete psychological study of each individual could be expected to reveal maturity differences in manifest traits and in behavior dynamics which are not clearly shown in the comparisons we have been able to make. The question may also be raised as to the adequacy of our criterion for selecting the early- and late-maturing.

It is doubtful if any single event in the maturing process for boys can be compared in psychological importance to the menarche in girls. Skeletal age, as a measure of maturing, is relatively satisfactory with regard to reliability and stability. It is applicable at all ages from birth to adulthood, and is therefore well adapted to longitudinal studies of the same individuals throughout their period of growth. But skeletal age is revealed only by x-ray. Individual differences in this variable are hidden, and hence have received no cultural value-assessments. Feelings of perplexity or inferiority may arise, in relation to early or

late skeletal maturing, only in so far as skeletal age is related to other physical features (such as size, strength, primary or secondary sexual characteristics) or to psychological changes in adolescence.*

It is not surprising that those who are retarded in skeletal development should often be directly aware of other aspects of physical retardation, and it is not surprising that this should lead to anxiety. We have seen, however, that there are many complicating factors, which make it difficult to predict the course which any individual adjustment will take. Some of our late-maturing boys enjoyed a degree of personal security, and status in other areas, which helped to balance their temporary physical inadequacies. A boy like Lonny, whose support at home was withdrawn at the same time that his retardation in growth became important, had a more serious problem than Tom, whose general security was adequate. Some of the early-maturing boys with fine physiques, nevertheless had disturbing accompaniments of rapid growth (such as severe acne), which tended to offset other advantages.

Our findings give clear evidence of the effect of physical maturing upon behavior. Perhaps of greater importance, however, is the repeated demonstration of the multiplicity of factors, psychological and cultural as well as physical, which contribute to the formation of basic personality patterns.

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A STUDY OF RATIONALIZATION

ROBERT COBB MYERS

Educational Testing Service

Princeton, N. J.

I

Early in October, 1947, we administered an attitude-interest questionnaire to the members of the freshman class of an eastern women's college who had been admitted to the college just three weeks before. We will call these our postadmission respondents. Subsequently in 1947, and throughout the spring and summer of 1948, we administered the same questionnaire to applicants desiring to enter this college as freshmen in the fall of 1948. These girls answered the questionnaire at the same time as they were completing their usual application papers. The admissions office of the college selected the new freshman class from among these applicants without recourse to the questionnaire responses. After this selection had been made, we segregated the questionnaires of the successful applicants for analysis. We will call these our preadmission respondents.* Altogether, there were three hundred sixty-two preadmission respondents, and three hundred fifty-five post-admission respondents.

The questionnaire contained one hundred forty-five attitude-interest items in the following areas: motivations for going to college, study habits and teacher relations, interpersonal relations and interests. Answers were given on equal-appearing-interval scales of various lengths: twenty-nine items being provided with four possible responses, ninety items having five possible responses, and the remaining twenty-six items having seven possible responses. Examples of items having different response scales follow:

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* These data were gathered as part of a larger study of nonintellectual factors in collegiate achievement being financed by the College Entrance Examination Board. The questionnaire was developed, pretested and administered under the general direction of H. S. Conrad. The insights of the following research staff members of the Educational Testing Service have been particularly helpful in analyses of the completed questionnaires: D. G. Schultz, W. B. Schrader, B. F. Green, Jr.

Four Response Scale

Item Example: How appealing would it be to you to join a group discussion on strategy for strengthening the United Nations?

Possible Responses:

1. Not at all interested.
2. Only slightly interested.
3. Moderately interested.
4. Warmly or quite interested.

First Five Response Scale

Item Example: How important was this reason in causing you to apply for admission to this college: The atmosphere is favorable to serious study?

Possible Responses:

1. Does not apply or is of no importance.
2. Of slight importance.
3. Of moderate importance.
4. Of considerable importance.
5. Of great importance.

Second Five Response Scale

Item Example: Do you feel that most teachers give you a "fair break"?

Possible Responses:

1. Yes.
2. Probably yes.
3. Uncertain.
4. Probably no.
5. No.

Seven Response Scale

Item Example: Do you feel discouraged after a session of studying?

Possible Responses:

1. Never.
2. Very seldom.
3. Rather seldom.
4. Sometimes.
5. Frequently.
6. Usually.
7. Always.

II

When the average responses of the preadmission cases were compared item by item with the average responses of the post-admission cases, we found that they differed significantly (CR of 2.00 or higher) in ninety, or sixty-two per cent, of the one hundred forty-five possible items. Table I shows the critical ratios which were found in this comparison.

TABLE I.—CRITICAL RATIOS OF QUESTIONNAIRE ITEM RESPONSE DIFFERENCES BETWEEN 362 PREADMISSION RESPONDENTS AND 355 POSTADMISSION RESPONDENTS

CR	Questionnaire Items		Cumulative Total	
	Number	Per Cent	Number	Per Cent
14.00–15.99	1	1	1	1
12.00–13.99	1	1	2	2
10.00–11.99	2	1	4	3
8.00– 9.99	4	3	8	6
6.00– 7.99	5	3	13	9
4.00– 5.99	28	19	41	28
2.00– 3.99	49	34	90	62
Below 2.00	55	38	145	100

In attempting to explain response differences of this magnitude between the Class of 1952 (preadmission respondents) and the Class of 1951 (postadmission respondents) one is faced with several options:

I) The differences reflect true attitudinal differences between the two groups which might be explained because:

(A) The groups might have come from different backgrounds and therefore were drawn from different populations.

(B) The preadmission students (Class of 1952) answered the questionnaire, on the average, several months after the post admission students (Class of 1951).

(C) At the time the preadmission students answered the questionnaire they were, on the average, about six months younger than the postadmission students had been.

(D) The preadmission students might have based their answers upon experience in high school, whereas the postadmission students might have based their replies upon experience in college (although they had had only three weeks of such experience at the time they filled in the questionnaire).

II) The differences do not reflect true attitudinal differences, but are simply an artifact which results because:

(A) The preadmission students answered the questionnaire in isolation, while the postadmission students answered in group situations.

(B) The preadmission students were under greater pressure to rationalize their responses since they had not yet achieved the goal of college entrance which they were seeking.

This list of possible plausible hypotheses illustrates once again the well-known difficulty that one can never statistically prove anything in social science; the best one can do is to find that the possibility of a given hypothesis being true has not been disproven. From our statistics alone we have certainly not disproven that any of the listed factors may not be at the root of the preadmission-postadmission response differences which we found. Although the magnitude of the differences may not by itself be able to resolve this dilemma, we can turn to the content of the items and judge which hypothesis seems to make the most sense, or be the most plausible, when compared to the quality of the differences.

We have carefully considered all the hypotheses in relation to the quality of the differences and have come to the conclusion that the hypothesis which seems to make the data as a whole hang together is the one which has been listed above as II(B). In another place* the writer has paraphrased Wallin to arrive at the general theorem that: "The interposition of a qualifying examination for a desired goal will ordinarily shift overtly expressed opinions in the direction deemed to be in conformance with achievement of the goal, i.e., in the direction of one's stereotype of the ideal goal achiever." When the pattern of the quality of the preadmission-postadmission differences within the ninety significant items is closely studied it appears clear that the preadmission respondents rationalized their responses in accordance with this theorem.

* R. C. Myers, "The Academic Overachiever: Stereotyped Aspects," *Journal of Experimental Education*, March, 1950.

We will now set down the qualitative differences found in the ninety significant items so that the reader himself may judge to what extent the hypothesis of greater preadmission rationalization seems to be the most plausible.

QUALITATIVE DIFFERENCES BETWEEN PREADMISSION AND POST-ADMISSION RESPONSES

1. *Motivations for Going to College*

A) Preadmission respondents gave greater emphasis than post-admission respondents to these reasons:

Going to college trains one for community leadership, provides educational extra-curricular activities, gives training in sociability through living in dormitories or sorority houses, provides an opportunity of making a great many new friends and these friends are valuable help in postgraduation job hunting, gives opportunity to learn more about a great many interesting things, improves one's conversational ability.

Choice of this particular college was made because respondent had always planned to go here, the atmosphere is favorable to serious study, the college has high intellectual standards and is strong in one's chosen major field of study, one benefits from the desirable social background as well as a good education, many girls from the best families go to this kind of college and the type of girl one would wish to associate with socially goes here, most of one's friends go here, the college is not coeducational and it is known for its attractive girls, it gets one away from home, the type of man desired as a husband will prefer a girl who has gone here, and future children will be proud that their mother went to this college.*

B) Preadmission respondents gave less emphasis than post-admission respondents to these reasons:

College is a good place to meet a desirable husband, there is not much to do at home, and expectations of family and friends necessitate college attendance. The tuition and other expenses at this particular college are comparatively low.

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* It should be noted here that although the college is an eastern liberal arts college, it is connected with a state university, draws its students from a broad cross-section of high-school graduates, and is by no means an 'exclusive eastern girls' school.'

2. *Teacher Relations and Study Habits*

A) Preadmission respondents presented greater agreement than postadmission respondents that they:

Had had teachers who generally explained things clearly, but that when something was not clear they asked the teacher about it, had teachers who gave them a "fair break," who seemed to care whether the students learned or not, and who stimulated the students to think about their courses, agreed with their teachers on what was considered important in their courses, had teachers who paid attention to them as individuals and who had made assignments clear, and that their teachers have appeared to like and enjoy the subjects that they teach.

Followed a study-plan or study-schedule, estimated prior to study periods about how much they were going to accomplish in the time available for each subject, and used odd moments (like time between classes) to review what they had learned, would be able to maintain an average of five hours per day of study in college if it were expected of them, believed that most of their school work had been rather closely related to their vocational goals, thought that examination grades really showed what one knew about a subject, believed that school marks or grades were generally useful and fair, but had confidence in their ability to pass an examination at the end of a course without studying for the exam, felt that the higher the grades a girl gets in college the more she will amount to after college and that grades are one of the most important aspects of school work, believed that the more one knows the more money one will eventually have.

B) Preadmission respondents presented less agreement than postadmission respondents that they:

Had found it difficult to understand what their teachers were 'driving at' in class, had teachers who failed to allow enough time to get assignments completed, found that their teachers had been unfair to them, and felt after an examination as if they had been tricked, accomplished more in courses where the teacher took a personal interest in them.

Lacked confidence in their ability to do satisfactory academic work, felt discouraged after a session of studying, and worried about their course work, read slowly, found it difficult to make up missed assignments and experiments or to get their daily assignments done on time, felt that much of what they had been learning in school was wasted effort and that many courses offered in

college are not useful to a woman, found it was easy for someone to persuade them to do something else instead of studying and thought that anyone who studies most of the time is a 'grind,' were able to study some subjects considerably better than others and liked practical subjects better than theoretical subjects, found that they spent too much time studying one subject and then had to hurry through the others, studied much more efficiently under the pressure of immediate necessity and thought that 'cramming' was the best practical way to get good grades on a final examination.

3. *Interpersonal Relations and Interests*

A) Preadmission respondents rated these attributes of girl friends as being more important than the postadmission respondents rated them:

Mutual curricular and extra-curricular interests, good thinker (independent and original), has interesting ideas on current affairs and well-cultivated tastes in literature, interested in politics, mutual interests in similar business or professional career, and keeps appointments on time.

They also indicated greater interest than the postadmission group in these discussion topics:

Communism in theory and practice, peacetime uses of atomic energy in industry, some needed civic improvements, defects of the U. S. Bureau of Labor Statistics cost-of-living index, regulation of labor unions by law, current developments in U. S. foreign policy, strategy for strengthening the United Nations, the housing shortage, rival techniques of color photography in motion pictures, travel by airplane vs. railroad, and a recent popular novel.

B) Preadmission respondents rated these attributes of girl friends as being less important than postadmission respondents rated them:

Interested in dating, gay and carefree (doesn't take life too seriously), and lacks enthusiasm for the serious 'career-minded' kind of girl.

They also indicated less interest than the post admission group in these discussion topics:

How to pick a husband, peculiarities of one's school teachers, and recent news of happenings among one's friends or acquaintances.

After reviewing the quality of the preadmission-postadmission

response differences, we see that the preadmission respondents preponderantly represented themselves as being more sober and industrious, better adjusted to the requirements of teachers, studying and examinations, having sounder motivations for college and presumably more acceptable reasons for wanting to attend this particular college, and more interested in having friends and discussions on the serious rather than the carefree side. That this is a result of greater rationalization on the part of the preadmission group, rather than representative of 'true' differences, we have little doubt.*

III

Not only did the preadmission respondents give responses which they appeared to rationalize as indicating 'better' attitudes on their part, but they also gave more extreme responses than did the postadmission group. This situation was anticipated, and stems from the hypothesis that overtly expressed opinions are apt to be more extreme when based upon rationalization than when based upon reality.† The ninety questionnaire items which had distinguished between the preadmission-postadmission responses with a CR of 2.00 or higher were, accordingly, tested against the following theorem: Considering that every questionnaire item was provided with a response continuum having a 'pro' terminus and a 'con' terminus, then whichever terminus, or pole, the average postadmission response falls nearer, the average preadmission response should fall still nearer (i.e., the

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* One is reminded of the earlier report of Simpson that "there is a tendency for penitentiary inmates to rate themselves higher than college students in the possession of generally desirable personality traits." (R. M. Simpson, "Self-rating of Prisoners Compared with that of College Students," *Journal of Social Psychology*, 1933, 4, 464–467.) Simpson's prisoners wanted 'out'; our preadmission students wanted 'in.'

† The conventional interpretation of extremeness of response is that it indicates greater intensity of opinion. Among the most recent to present this viewpoint is Stouffer who postulates that: "People with the most extreme opinions, pro or con, also tend to hold these opinions with the greatest intensity." (Samuel Stouffer et al., *The American Soldier*, Vol. I, *Adjustment During Army Life*, Princeton, N. J.: Princeton Univ. Press, 1949, p. 43). This viewpoint may be sound so long as one is referring to covertly held opinions only. However, when one is discussing overtly expressed opinions, the hypothesis that greater extremeness of response indicates greater rationalization may be equally valid, depending upon the social situations under which the responses being compared were obtained.

direction of the preadmission response from the postadmission response should be further toward the terminus closest to the postadmission response). The result of this test showed that the conditions of the theorem had been met in the case of sixty-two (sixty-nine per cent) of the ninety significant questionnaire items. According to the Sign Test advanced by Dixon and Mood* we can consider our theorem of extremeness of response on the part of the preadmission respondents to have been upheld at the one per cent level of significance.

A precise illustration of this situation would have involved determining experimentally what Stouffer would call a "region of relative indifference" on the continuum for the entire group of respondents, and then demonstrating that the responses of preadmission students tended to be further removed from this region than those of postadmission students. But, lacking this, we arbitrarily selected the midpoint of each response continuum as most likely being representative of relative indifference. Reference may be made to Table II for an illustration of our method. Here are presented 15 significant items, from a section with a five-place response continuum, in the same sequence as they appeared in the questionnaire. Using the mid-point answer ("Uncertain") as a reference point, one notes that in the case of 10 of these 15 items the direction and place of the arrow shows that the conditions of our theorem of extremeness of response on the part of the preadmission group have been met. In the case of 5 of these 15 items the conditions have not been met.

IV

An interesting by-product of this investigation has been the provocative finding that the magnitude of the Critical Ratio of the difference between the preadmission and postadmission responses seems to be directly related to the length of the response continuum which was provided for each item. Earlier in this paper we mentioned that, of the one hundred forty-five items in the questionnaire, twenty-nine had been provided with four possible equal-appearing-interval responses, ninety with five possible responses, and twenty-six with seven possible responses. When the data presented in Table I are broken down by these

* W. J. Dixon and A. M. Mood, "The Statistical Sign Test," *Journal of the American Statistical Association*, 1946, 41, 557–566.

TABLE II.--ILLUSTRATING THEOREM OF COMPARATIVE EXTREMENESS OF RESPONSE ON THE PART OF PREADMISSION RESPONDENTS

Item	CR	Responses (Mean response of Postadmission students indicated by long line (|); that of Preadmission students by short line (ˈ). Arrow indicates direction of difference.)
		YES · PROBABLY YES · UNCERTAIN · PROBABLY NO · NO
Do you feel you accomplish more in courses where the teacher takes a personal interest in you?	3.57	
Do you like practical subjects more than theoretical subjects?	3.70	
Are you able to study some subjects considerably better than other subjects?	3.39	
Have your teachers seemed to care whether the students learned or not?	4.30	
Do you read slowly?	5.62	
Do you think that the more you know the more money you will eventually have?	2.42	
If it were expected of you, would you be able to maintain an average of 5 hours per day of study in college?	7.92	
In general, have your teachers stimulated the students to think about their courses?	5.46	
Do you feel that the higher the grades a girl gets in college the more she will amount to after college?	9.58	
Has most of your school work been rather closely related to your vocational goal?	3.14	
Do you place importance on the idea that your college career will train you to participate actively in your community?	2.81	
Do you think that anyone who studies most of the time is a "grind"?	2.63	
Do you feel that most teachers give you a "fair break"?	5.76	
Do you consider grades one of the most important aspects of school work?	2.25	
Do you agree that "cramming" is the best practical way to get good grades on a final examination?	3.74	

TABLE III.—CRITICAL RATIOS OF QUESTIONNAIRE ITEM RESPONSE DIFFERENCES BETWEEN 362 PREADMISSION RESPONDENTS AND 355 POSTADMISSION RESPONDENTS, BY LENGTH OF RESPONSE CONTINUUM

CR	Length of Continuum					
	4 Responses		5 Responses		7 Responses	
	Number of Items	Per Cent	Number of Items	Per Cent	Number of Items	Per Cent
14.00–15.99					1	4
12.00–13.99					1	4
10.00–11.99					2	8
8.00– 9.99			1	1	3	12
6.00– 7.99			3	3	2	8
4.00– 5.99	2	7	15	17	11	42
2.00– 3.99	12	41	32	36	5	19
Below 2.00	15	52	39	43	1	4
Total	29	100	90	100	26	100

three different response continua, we find the situation shown below in Table III.

The difference in distribution of CR's between items having a four-response continuum and those having a seven-response continuum is significant (CR = 4.32); also significant is the difference between the CR's of the five-response items and the seven-response items (CR = 3.55). The difference in distribution of CR's between the four-response and the five-response items would generally be considered not to be significant (CR = 1.71).

We realize, of course, that these rather striking differences may be a function of differences in item content between the various sections of the questionnaire.* However, there was a good deal of overlap in content between items having different lengths of

* This problem will not be resolved satisfactorily until we, or some other experimenters, have had an opportunity to try out items having different lengths of response continua, but exactly the same item content, on matched samples of respondents.

response continua, and we suspect that the differences are, at least to some degree, a function of the length of the response continuum. To us, a reasonable explanation of this phenomenon would seem to be that there is a greater reluctance on the part of attitude-interest respondents to select a terminal (most extreme) response than some other optional response provided on a questionnaire. In the case of a seven-response item, the terminal responses can be avoided and still leave five responses from which to choose, thus allowing discrimination to that degree. However, in the case of a four-response item, if the terminal responses are avoided the respondent is left with only two options between which to choose, thus allowing but minimal opportunity for discrimination.

Using present Critical Ratio formulas, one might attempt to find the optimum length of the response continuum to yield the largest possible CR's for response differences between any two differentiated groups. Or, approaching the problem from another direction, one might set out to determine how the Critical Ratio formulas should be modified so that the CR will be held constant when nothing varies except the length of the response continuum.

SUMMARY

An attitude-interest questionnaire was especially designed for administration to entering female college freshmen. It has been administered to the members of two successive freshman classes at an eastern women's liberal arts college; in one case shortly after the students had been admitted to the college, and in the other case when the students were applying for admission. Of one hundred forty-five items in the questionnaire, the answers given to ninety were found to discriminate significantly (CR of 2.00 or higher) between the preadmission and postadmission groups. A qualitative analysis of these differences appeared to indicate that the preadmission respondents were more inclined to rationalize their responses than were the postadmission respondents. It was also found that the preadmission group gave more extreme responses, and this was shown to be significant at the one per cent level. From a subsidiary finding the question is raised as to whether or not differences found in magnitude of CR's may be a function of the different lengths of response continua provided for different section of items.

HOSTILITY, COMMUNICATION, AND INTERNATIONAL TENSION: II. SOCIAL GROUP BACKGROUNDS

HARRY A. GRACE
University of Illinois

A. HYPOTHESES AND INTRODUCTION

This study is designed to find what relationships exist among expressions of hostility in three kinds of social situations: everyday, professional (teaching), and international situations. The hypotheses are that: (a) different categories of hostile responses exist in given social situations; (b) measures of hostility among the three different kinds of social situations are related; and (c) there are differences in social backgrounds between those groups scoring at the extremes in types of social situations and categories of hostility. The development of the instrument used in this study, a discussion of its reliability, and of the results which refer to hypotheses (a) and (b) are reported in an earlier paper.[5] This paper is concerned with the results of the comparisons of the social backgrounds of subjects scoring at the extremes on this inventory.

B. METHOD AND PROCEDURE

The instrument used in this study includes short verbal situations in three fields* of social behavior: (a) everyday, (b) professional (teaching), and (c) international. Everyday situations include stubbing one's toe, having a letter returned unmailed, etc. Professional situations concern problems of classroom discipline, student-teacher relations, etc. International situations center about relations between the United States and other countries, and include such things as the death of an American in China, the British tax on American films, etc.

After a preliminary test four categories† of hostile response were formed: autohostile, (expression of hostility against the self or the in-group), *laissez-faire* (allowing the action to continue without interference by the subject), verbal-heterohostile, (using verbal abuse against a target away from the self or in-group), and

* Hereafter these areas of social behavior will be called fields.

† Hereafter these responses will be referred to as categories.

direct-heterohostile (directly attacking a target other than the self).

Thirty situations in each of the three fields with the four categories in random order after each situation were given to two hundred ten students at Teachers College, Columbia University in the spring of 1948. The average age of the group was thirty-one. The group was heterogeneous in background, having come from all parts of the country. The following social background data were solicited anonymously: sex, age, marital status, veteran status, parents' nation of birth, subject's nation of birth, parents' annual income,* subject's annual income,* parents' occupation,* subject's occupation,* and subject's political and religious preferences. (See Table I.)

C. RESULTS

After the item analysis there remained twenty-two situations in each field for final scoring, a total of sixty-six situations. The reliability, validity, and differences among the various fields, categories, and field-categories† are discussed in other papers.[4,5] Since the relationships between fields and categories are important for full understanding of the importance of social group backgrounds, the data are summarized below.

The three fields were not found to be significantly different from each other. The categories of hostility, however, differ very significantly from each other. The subgroup interaction, represented by the field-categories, also showed significant differences.

Social backgrounds of the high twenty per cent and the low twenty per cent of the subjects scoring in each of the field-categories were compared.‡ A difference of twenty-two percentage points is necessary for significance on the five per cent level, and twenty-eight percentage points' difference is necessary for significance on the one per cent level.[18] Eighteen percentage points' difference has been taken as approaching significance on

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* These data could not be included since so many of these questions were unanswered by the subjects.

† The word field-category refers to the relationship between any field and any one of the four categories, e. g., everyday-autohostile, international-verbal-heterohostile, etc.

‡ Full table of these data may be found in [4].

TABLE I.—SUMMARY TABLE OF THE SOCIOECONOMIC GROUPS REPRESENTED IN THIS STUDY. RAW NUMBERS ARE GIVEN IN THE FIRST COLUMN. THE PERCENTAGE FALLING IN EACH CLASSIFICATION IS GIVEN IN THE SECOND COLUMN. TOTALS WHICH DO NOT EQUAL N OR 100 PER CENT ARE THE RESULT OF OMMISSIONS.

Sex	Raw Number	Per Cent of Sample
Female	125	60
Male	83	40
Marital Status		
Married	65	31
Single	145	69
Veteran Status		
Non-Veteran	119	57
Veteran	91	43
Parents' Place of Birth		
Outside United States	71	34
Inside United States	137	65
Subject's Place of Birth		
Outside United States	14	07
Inside United States	193	92
Political Preference		
Republican	44	21
Democrat	74	35
Liberal	26	12
None	47	23
Progressive	10	05
Independent	09	04
Religion		
Roman Catholic	38	18
Protestant	107	51
Jewish	29	14
None	21	10
Agnostic and Atheist	08	04
Occupation*		
Parents' Income*		
Subject's Income*		
N = 210		

* Insufficient responses.

TABLE II.—SUMMARY OF SOCIAL BACKGROUND DIFFERENCES DISCUSSION IS GIVEN IN THE TEXT*

A Republicans

	E	P	I
H	a	a	
L			−a
H			−V
L	−v		
H			d
L	−d		

B Democrats

	E	P	I
H			
L		−a	
H	v		
L			

C Progressives

	E	P	I
H			A
L	−A		
H			
L			−v
H			
L			−d

D Second Generation

	E	P	I
H		A	A
L	−A		
H	*l*	*l*	
L			−*l*

E Protestants

	E	P	I
H	a	a	
L			−a
H			+*L*
L		−*L*	
H			V
L		−V	
H			+D
L	−D		

F Roman Catholics

	E	P	I
H			v
L			

G Non-religious

	E	P	I
H			
L		D	−D

H Veterans

	E	P	I
H			a
L	−a	−a	

J Married

	E	P	I
H		*L*	
L	−*L*		

K Females

	E	P	I
H	*L*		
L			−*L*
H		D	
L	−D		

* Capital letters denote relative relationships between fields. H and L refer to high and low groups. E, P, and I refer to everyday, professional, and international fields. A, *L*, V, D, both lower case and capitals, refer to autohostile, *laissez-faire*, verbal-heterohostile, and direct-heterohostile categories.

the five per cent level. In the summary (Table II) only those data which approach significance on the five per cent level, or which are significant on the five or one per cent levels have been included. These data reinforce themselves in various proportions which may be derived from the raw data.

Republicans tend to be autohostile in everyday and professional situations, but not in international situations. They are not very verbal-heterohostile in international situations, but they are more often that way in international situations than in everyday situations. Republicans are not direct-heterohostile in everyday situations, but they are directly heterohostile in the international field. (Subtable A.)

According to the data presented in Subtable B, Democrats are verbally heterohostile in everyday situations. They are not autohostile in professional situations for the sample tested.

Progressives tend to be autohostile in international situations, but much less autohostile in the everyday field. In the international field, the Progressives are neither verbally nor directly heterohostile. (See Subtable C.)

Subtable D represents the data regarding the second-generation Americans. They do not tend to be autohostile in everyday affairs, but they are autohostile in professional and international affairs. They are *laissez-faire* in the everyday and professional fields, but not in the international field.

Protestants show autohostility in everyday and professional situations, but they are not autohostile in international situations. They are much more *laissez-faire* in international situations than in professional situations. Protestants are more verbally heterohostile in the international field than in the professional field. They are much more directly heterohostile in the international field than in the everyday field. (See Subtable E.)

Roman Catholics tend to be very verbal-heterohostile in the international field. (See Subtable F.)

Subtable G shows that the non-religious group is low in direct-heterohostility in both the professional and international fields, although it is even less directly heterohostile in the international field than in the professional field.

Subtable H concerns the veterans in this sample. They are not autohostile in the everyday and professional fields, but more autohostile in the international field. The non-veterans are

less autohostile in the international field than in the everyday and professional fields.

Married people are more *laissez-faire* in professional than in everyday situations. (Subtable J.)

Women are more *laissez-faire* in the everyday field than the international field. In addition, they are more directly heterohostile in professional than everyday situations. Men react in the opposite direction from women in these two dimensions. (Subtable K.)

D. DISCUSSION

Reliability.—To summarize the discussion on reliability of the instrument used in this study, it is suggested that in some fields (e. g., everyday and professional) individuals have developed generalized responses, whereas in the international field more specific responses are forthcoming.

Laissez-faire behavior seems to be a generalized tendency for operations in all of the fields tested.

Fields and Categories.—The three fields (everyday, professional, and international) appear to be subfields of the general area of human social behavior. Significant differences do not appear between the fields. The categories (autohostile, *laissez-faire*, verbal-heterohostile, and direct-heterohostile) are highly significantly different from each other. The subgroup interaction (field-categories) is statistically significantly different. High scorers in a given category in one field tend to be high scorers in the same category in the other fields. Low scorers in a given category in one field tend to be low scorers in that category in other fields.

Social Background Data.—These data come from the high and low twenty per cent of the scorers on each field-category. All references to groups apply only to those samples which were tested in this study.

Republicans tend to be autohostile in everyday and professional situations, but contrary to this are direct-heterohostile in international situations. They tend to be more verbally heterohostile in international than everyday situations. Thus Republicans on this sample tend to direct their hostility toward themselves in everyday and professional affairs, and toward others in international affairs.

Protestants are similar to Republicans in their ways of expressing hostility. They tend to be more *laissez-faire* in the international field than in the professional field, as well as being more heterohostile in the international field than in the other two.

The Roman Catholics tested parallel the Republican and Protestant groups by their heterohostility in international affairs. This may indicate the similarity among the programs of these three groups in the international field today.

Second-generation Americans tend to be autohostile in international situations, and not very heterohostile at all in that field. They are not *laissez-faire* in the international field, but do act this way in the other fields.

The Progressives approximate the second-generation group, and like it are at variance with the Republican-Protestant-Roman Catholic group discussed earlier. Progressives tend to be very autohostile in international affairs although not in everyday affairs, and show no heterohostility in international affairs.

Veterans are highly autohostile in the international field, but not so in the other fields. They are very similar to the second-generation Americans and the Progressives. This suggests that the war experiences may have had some effect on the veterans, perhaps putting them in closer contact with international problems, making them more critical of our international policies, or perhaps motivating them towards the prevention of a future war.

The non-religious group, which shows low direct-heterohostility in the international field, lower also than in the professional field, seems to support the tendencies of the Progressives, veterans, and second-generation Americans.

The Democrats do not seem to be a homogeneous group in this sample. This may be due to the party's internal political difficulties or to regional differences. Democrats are verbal-heterohostile in everyday affairs, but not very autohostile in professional situations. Otherwise their data are not significant. These data were collected before the 1948 convention, when the party's policies were still in formulation.

Women seem to be able to express direct-heterohostility more in professional situations than are men, but men express this hostility more often in everyday situations than do women. This may indicate the need for further research regarding our

cultural mores as they pertain to the ways and fields in which men and women may be expected to express their heterohostility. Perhaps male teachers and administrators are expected to act differently in frustrating situations than their female counterparts. Such data should prove to be important in the social psychological analysis of the school in our society.

Related Attitude Studies.—The social background data obtained on this inventory closely parallel attitude studies designed to measure internationalist-nationalist, war-peace, or militarism-pacifism attitudes.

Droba,[1] Hayes,[6,7] Stagner, et al,[13] and Stagner[14,15] reinforce the data in this study relative to political differences.

Eckert and Mills,[3] Katzoff and Gilliland,[8] Sappenfield,[12] Stagner et al,[13] and Stump and Lewis[17] are concerned with religious preferences which are similar to the findings in this study. Data on military training seem to differ from the data found in this study. Military training seems to be inversely related to internationalist attitudes in studies done by Dudycha,[2] H. W. Rogers,[11] Stagner, et al,[13] and Stagner.[14] Data in this study regarding subjects of foreign-born parents are reinforced by Queener's study,[10] although Eckert and Mills[3] do not find a significant difference for second-generation subjects.

Educational Implications.—Strang[16] suggests that aggression may be channelled in non-destructive directions by means of a careful educative process. She suggests that this training begin in the home and carry through the life of the individual. Queener's study[10] leads him to conclude that rewards and prestige are more frequently given for nationalistic attitudes in our culture.

Strang's solution requires action on the genetic levels of child training, and Queener's, action directed toward changes in group identification. Queener's argument lends some weight toward the concept of building international loyalties through multi- or supra-national interests such as workcamps, the arts, the sciences, etc. In any case, we seem to be weakest on action steps after we have diagnosed our difficulties.

A fruitful hypothesis is offered by Newcomb[9] who suggests that hostility of an autistic nature develops when two or more groups are not in communication with one another. With the development of this autistic hostility it becomes increasingly

difficult to establish communication, and so the cycle proceeds. Postwar international relations between the United States and the Soviet Union seem to be a case in point.

The data in this study seem to support Newcomb's thesis. The recent war experiences of the veterans, their travels, their contacts with other national citizens, and their reaction to war may account for their perception of international problems. The recent arrival of the second-generation Americans' parents in this country, their probable contacts with foreign languages, foreign newspapers, recent immigrants from their home lands, and their vicarious experiences during the past war may be offered as an explanation of their perception of international affairs. The foreign policy of the Progressive Party, the newspapers, periodicals, and speeches read and listened to by Progressives may offer some clues as to the forces which form their frame of reference. We might expect some of the persons who claim no religion on this sample to be humanistic in their world outlook, and, in so doing, to avoid heterohostile reactions which might lead to war. In contrast the foreign policy of the Republican Party, the editorial policy of newspapers which Republicans might be expected to read, the traditions of individualism and isolation (physical and psychological), and the probability of less contacts between Republicans and persons of foreign birth, might account for the Republicans' frame of reference. Protestants might be expected to be similar to the Republicans in these respects. The Roman Catholic group on this sample is probably influenced greatly by the diplomatic policies of the Vatican, and so information received from that source might be expected to build their particular world outlook.

In summary, it is suggested that for this sample, the differences among expressions of hostility in the international field may be accounted for by differences in the kind and degree of verbal and physical contact (communication) with international affairs. It is further suggested that controlled changes in communication may be expected to affect the types of hostile responses of the groups studied. This is a suggestion for future research and has not been fully covered in this study.

If the process of education for better international understanding be seen as a re-educative or therapeutic one, Newcomb's hypothesis seems to be most fruitful for further action-research.

The problem becomes one of bringing the groups into better communication with the international field. The differences may then be considered to be essentially dynamic rather than genetic in character. The genetic approach to this problem is too often fraught with hypothetical causal relationships which operationally are meaningless questions. Studies in methods for the improvement of communication between groups become of greatest importance.

The problem of what type of education is needed to develop adults who express hostility in ways which are non-pathological to themselves and to society is one which deserves deepest consideration. Since individuals tend to exhibit consistent patterns of hostility, it may be important to discover the relationships between these patterns and other personality characteristics. Perhaps of greatest interest to the educator are the data demonstrating the consistency of these patterns of hostility for the individuals on this sample. This suggests that the change of an individual's expression of hostility in one field will affect a similar change of that expression in another field. Should this be demonstrated (research is underway), we would be able to educate less directly but more generally and effectively for healthy international relations involving fewer tensions.

To attempt any large scale educational program before completing further research to more conclusively determine the most effective techniques, would be presumptuous. However, the data do offer a field for hypotheses, some of which have already been raised in the discussion, and some of which appear below.

SUGGESTIONS FOR FURTHER RESEARCH

1) A study of hostility patterns might be done with subjects who are at various stages of teacher-training or post-graduate teacher-training. Such data might yield information helpful in the selection of teacher candidates. Social studies teachers might constitute a special group for study since they will be faced with the interpretation of international problems throughout their professional work.

2) The original study reported here might profitably be altered for standardization with other minority groups.

3) Subjects might be sorted into groups on the basis of their scores on this inventory, and studies made of their overt hostile

behavior in a group setting. Their reactions to the group process in education may be closely identified with their hostility patterns. Such data should prove valuable for educators using group dynamics methods.

E. CONCLUSIONS

1) Republicans, Protestants, and Roman Catholics on this sample tend to express more heterohostility in the international field than they do in the everyday and professional fields. In the everyday and professional fields the Republicans and Protestants on this sample tend to be autohostile.

2) Progressives, second-generation Americans, and veterans on this sample tend to express autohostility in the international field. Progressives and second-generation Americans tend to be much less autohostile in the everyday field. Progressives tend to be less autohostile in the professional field, too. Non-religious persons do not tend to be direct-heterohostile in the professional field, and are even less directly heterohostile in the international field.

3) With regard to the third hypothesis of this study, it has been shown for the two hundred and ten subjects tested that certain significant differences exist between extreme scorers in field-categories with reference to their social group backgrounds.

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FACTOR ANALYSIS OF PSYCHIATRIC IMPRESSIONS

J. A. RAFFERTY and W. L. DEEMER, JR.
Department of Biometrics
USAF School of Aviation Medicine
Randolph Field, Texas

INTRODUCTION

There has always been controversy over the relative merits of personal opinions and objective measurements as selectors of personnel. In a simple situation, the grade-school teacher insists that his evaluation of a pupil has as much weight on a report card as examination scores. In a more complicated situation, the psychiatrist maintains that his concept of the etiology of a patient's disorder is more accurate than the composite results of a battery of psychological and psychiatric tests. Intuitionists and non-scientifically trained persons are often guilty of over-emphasizing the importance of personal opinions. Psychometricians and zealous immature scientists are often guilty of over-emphasizing the importance of measurements.

Few honest attempts have been made to assess the relative merits of these antipodes. Yet, it is worth while to do so. For instance, in a large scale selection program, as in the selection of young men for flying training in wartime, decisions have to be made in regard to the type of selectors used. On the one hand, impressions from interviews have the advantages of flexibility and of the weighted summarization of information due to the Gestalt-like features of the mind. On the other hand, objective test batteries have the advantages of convenient administration to large groups of subjects and statistically definable selection power. Efficient administration of such a selection program requires a knowledge of the order of magnitude of these advantages. Furthermore, it is of scientific interest to compare the statistical activities of the human brain to the techniques of psychometrics.

The work of this paper was undertaken to estimate the efficacy of clinical impressions as selectors in a particular selection program, and to study the nature of clinical impressions as products

of the brain as a statistical machine. The particular program was the selection of candidates for flying training in World War II. Thus the data of this study are fixed historically, and therefore it is recognized that the results may not have as broad an application as one might hope for. The results here are presented as evidence for the conclusions; not as proof.

METHODS AND RESULTS

To a group of three hundred eighty-nine physically-fit young men inducted into the armed services in 1943, especially thorough psychiatric interviews were given by flight surgeons. The subjects were a more or less random sample of applicants for training. The interviewers were graduates of a course in aviation medicine in which the psychiatry of flying personnel was taught.* The psychiatric examination was called the ARMA, the Adaptability Rating for Military Aeronautics. This group of applicants was allowed to go through flying training regardless of the opinion of the psychiatrists. Hence, the actual failures in training can be compared with the predicted failures.

At each interview the psychiatrist completed a check-list of thirty-one psycho-social items and then wrote down his prediction for success in flying training (item 32) and for success in combat (item 33). An abbreviated list of these items is shown in Table I. Detailed description of the items is given elsewhere.[1] The actual outcome of elementary flying training is also given in Table I as item 34, 'Criterion.' Thus, the matrix of Table I yields the interassociations, in adjusted contingency coefficients,† for all pairs of items of the interview, and for each item with the criterion. Clusters of related items are evident at first glance. Valid items, those which were able to predict failures, are easily picked out in the last row or the last column where the coefficient

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* A complete description of the subjects and the interviewers is given in Deemer and Rafferty.[1]

† Adjusted contingency coefficient is designated by C.

$$C = \sqrt{\frac{\chi^2}{N + \chi^2} \frac{\sqrt{hk}}{\sqrt{hk} - 1}}$$

where: χ^2 = Chi-square computed on h by k contingency table $N = 389$
In Table I, C is written as $100C$ to eliminate decimal points. The statistical significance of C is that of the χ^2 on which C is computed.

is prefixed by *a*, the five per cent significance level value of the coefficient (chosen arbitrarily as statistically significant association between items.) The valid items are 'Nationality,' 'Achievement,' 'Prediction for success in flying training,' and 'Prediction for success in combat.'

Clusters of items are of particular interest, since few psychosocial items *per se* were good selectors but the clinical impressions based on these items were relatively good selectors.* One would like to know how these various items are related so as to supplement one another in the considered opinion of the psychiatrists. First, a coefficient by coefficient subjective analysis was made of

Table I. AMA item interassociations expressed as contingency coefficients (C's) in percent, high values of which indicate high associations.

Item No.	Item	Item No.																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	Age		25	20	20	15	14	14	17	14	-15	a31	-17	b42	15	16	a22	22	24	9	12	12	b40	b44	a20	19	10	10	25	12	17	b22	-18	-16	16
2	Nationality	25		25	19	10	11	a16	5	11	a19	14	a23	- 7	a25	14	8	20	10	12	b32	15	17	a14	19	14	17	0	21	19	17	a25	-17	-12	a21
3	No.Brothers	20	25		b37	16	17	7	6	a20	12	8	11	21	9	16	6	14	7	11	a27	17	11	9	5	12	10	3	a18	9	17	14	a20	a22	14
4	No.Sisters	20	19	b37		b30	b28	16	8	10	12	12	7	a25	11	14	9	14	10	15	19	15	8	10	11	15	12	9	22	13	15	20	15	17	18
5	Parental Status	15	10	16	b30		b23	a25	5	11	9	7	14	4	11	7	2	a19	11	a24	a17	6	a20	7	7	10	6	6	9	16	6	13	10	11	8
6	Upbringing	16	11	17	b28	b23		a24	4	8	6	8	6	6	2	5	7	a20	4	a13	8	5	a17	5	4	4	8	2	11	a20	4	2	5	6	9
7	Income	14	a16	7	16	a25	a24		0	0	14	11	10	15	10	0	6	6	7	4	8	12	4	2	a22	a20	a22	8	10	13	9	9	-11	-12	17
8	Habitus	17	5	6	8	5	4	0		10	a26	a18	10	8	a17	7	2	2	1	0	11	6	5	a18	a29	a29	11	a20	a24	6	17	1	a21	a24	15
9	Reactions	14	11	a20	10	11	0	0	10		7	14	4	13	a18	5	6	8	a25	a25	0	a29	2	10	8	12	a28	a22	a35	13	8	10	a27	a23	19
10	Tension	-15	a19	12	12	9	6	14	a26	7		a57	a61	a22	11	17	6	a23	0	0	15	10	7	9	12	a50	a32	a50	a34	a17	a25	14	a22	a26	15
11	Tremor	a31	14	8	12	7	0	11	a19	14	a57		a99	15	0	8	3	12	3	8	7	12	8	3	4	a26	a22	a20	17	8	15	11	a16	13	4
12	V.F.I.	-17	a23	11	7	14	6	10	10	4	a61	a99		11	10	8	13	14	12	11	0	11	3	2	10	a12	a11	a25	15	0	14	7	9	12	4
13	Achievement	b42	- 7	21	a25	4	5	15	8	13	a22	15	11		12	15	13	14	15	2	10	9	b34	b27	a26	a26	16	12	a34	9	21	14	a26	a30	a30
14	Blood Sports	15	a25	9	11	11	2	10	a17	a18	11	0	10	12		a17	0	3	0	15	12	7	10	a14	a20	a29	a18	2	18	a27	a22	12	12	14	10
15	Artistic	16	11	16	14	7	3	9	7	5	17	8	8	15	a17		3	18	0	10	8	9	12	10	7	11	3	a19	a20	9	17	8	14	11	14
16	Habits	a22	8	6	9	2	7	6	2	6	6	3	13	13	0	4		5	15	0	0	6	0	2	a21	9	11	12	13	12	17	14	5	13	20
17	Alcohol	22	20	16	14	a19	a20	6	2	8	a23	12	11	14	5	18	5		8	a27	a19	12	a26	a29	0	8	12	8	15	5	4	13	a17	-14	12
18	Tobacco	14	10	7	10	11	4	7	1	a25	0	3	12	15	0	0	15	8		a27	12	a25	8	8	0	11	9	5	11	7	13	a25	9	14	14
19	Gambling	9	18	11	15	a26	a18	4	0	a25	0	8	11	2	15	10	0	a27	a27		6	17	5	3	8	18	a23	12	15	6	7	15	7	12	3
20	Religion	12	b32	a27	19	a17	0	8	11	0	15	7	0	10	12	8	0	a19	12	6		a35	a21	11	a15	10	11	5	17	8	14	10	-11	- 9	25
21	Religiousness	12	15	17	15	6	5	12	6	a29	10	12	11	9	7	9	8	12	a25	17	a35		7	3	5	19	11	11	16	20	12	5	8	11	14
22	Marital	b28	17	11	8	a20	a17	4	5	2	7	8	3	b36	10	12	0	a26	8	5	a25	7		b72	a40	9	13	10	12	11	a20	11	8	10	4
23	Children	b24	a24	9	10	7	5	7	a16	10	9	1	2	a27	a11	13	2	a29	8	3	11	3	b72		a25	5	9	5	14	9	a15	13	9	5	7
24	Sex Drive	a28	19	5	11	7	4	a22	a29	8	12	4	10	a26	a20	7	a21	0	0	8	a15	5	a40	a25		a18	a18	0	18	13	a29	b21	5	0	10
25	Attitude	19	16	18	15	10	4	a20	a29	12	a50	a40	a12	a26	a29	11	9	8	11	18	10	10	9	5	a18		a42	a13	a32	4	a28	6	a17	a26	18
26	Aggression	10	17	10	12	6	8	a22	11	a28	a32	a22	a11	16	a18	3	11	12	9	a25	11	11	13	9	a18	a42		a25	b42	a25	a27	6	a21	a22	4
27	Personality	10	0	3	9	6	2	8	a20	a22	a30	a20	a23	12	2	a19	12	8	5	12	5	11	10	5	0	a19	a25		15	21	a16	7	a21	a21	17
28	Personal Qual.	23	21	a28	22	9	11	10	a25	a35	a34	17	15	a34	18	a20	13	15	11	15	17	16	12	14	18	a32	b42	15		16	a30	13	a34	a34	19
29	Family Attitude	12	19	9	13	14	a20	13	6	13	a17	8	0	5	a27	9	12	5	7	6	8	a20	14	9	13	4	a25	21	16		b27	12	5	14	6
30	Interest in Fly	17	17	17	15	8	4	9	17	8	a23	15	14	21	a22	17	17	4	13	7	14	12	a20	b15	a29	a28	a27	a16	a30	b27		b32	a20	a25	22
31	Passenger Time	b22	a25	16	20	13	2	9	1	10	14	11	7	14	12	8	14	13	a25	13	10	5	11	13	b21	6	8	7	13	12	b32		a21	a20	17
32	Pred.Training	-18	-17	a25	15	10	5	-11	a21	a27	a22	a16	9	a25	12	14	3	a17	5	7	-11	8	8	9	3	a17	a21	a21	a34	5	a20	a21		a25	a20
33	Pred.Combat	-16	-18	a25	17	11	6	-12	a24	a25	a26	13	12	a29	14	11	13	a24	14	12	- 9	11	10	5	0	a26	a22	a21	a34	14	a23	a20	a25		a21
34	Criterion*	16	a31	16	10	8	9	17	13	19	15	4	4	a30	10	14	20	12	14	5	25	14	4	7	12	18	4	17	19	6	22	17	a20	a21	

*Criterion: Eliminated for all reasons, all students in elementary training.

Note: The adjusted contingency coefficient, C, has the limits: zero to 100 percent. Values of C between 20 and 25 are derived from χ^2's near the 5 percent significance level.

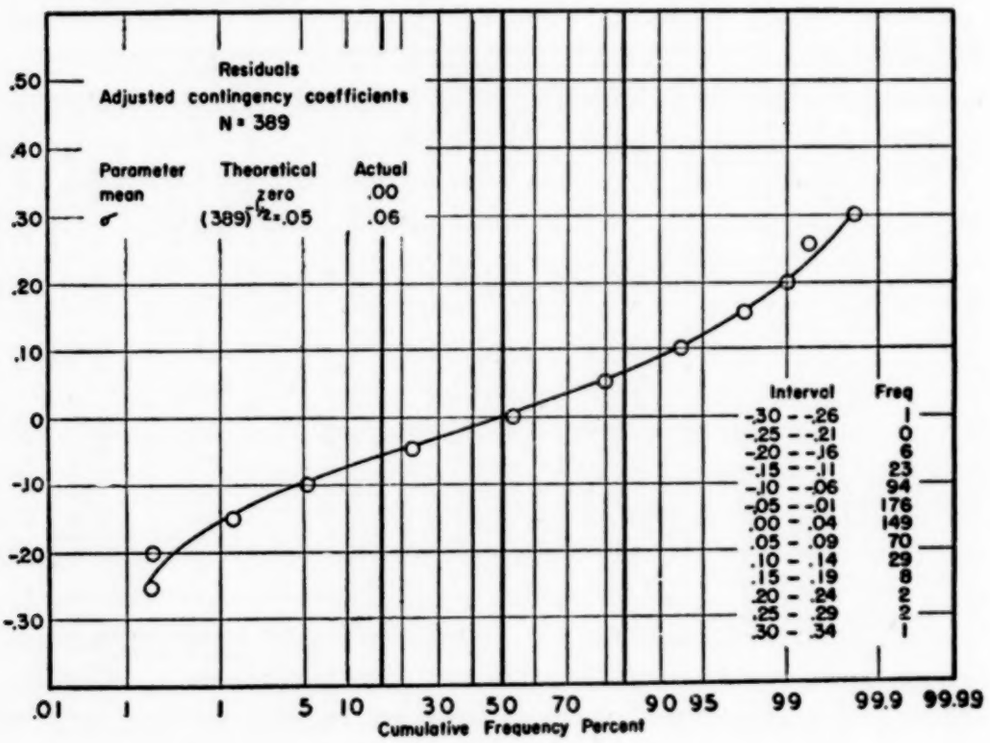
Legend:
a, b, c: Statistically significant association.
a: Natural relationship between items.
b: Systematic relationship between items.
c: Semantic relationship between items.
-: Important lack of association.

statistically significant associations in regard to the type of relationship between items. In Table I judgment of the type of relationship is signified by prefixing the coefficient with either *a*, for natural relationship, *b*, for systematic relationship, or *c* for semantic relationship. Furthermore, an examination of the cases of statistically insignificant association in relation to what the interviewers thought, as reflected in interassociations with the clinical impression items (nos. 31 and 32), led to the judgment of important lack of association, signified by the prefix −.

* The adjusted contingency coefficient, *C*, for the clinical impressions was about .40, which is comparable to the correlation coefficient of .55 for the psychological test battery given to these same subjects.[1]

Second, a multiple factor analysis was performed on the matrix of interassociations of Table I. The centroid method of factoring of Thurstone[2] was employed. Factoring was terminated when the distribution of residual contingency coefficients, after the removal of components due to the factors already found, was approximately normal with a mean of zero, and a standard deviation of nearly $(389)^{-\frac{1}{2}}$, the theoretical values for random fluctuations of correlation coefficients based on three hundred

Figure 1. Distribution of residuals in the factor analysis of ARMA items, after the extraction of four factors.



eighty-nine individuals. This distribution is shown in cumulative form in Figure 1.

Four factors, A, B, C, and D, were sorted out as accounting for the common variance of the thirty-four items. The factor loadings and the communalities are listed in Table II, after one rotation. Other rotations, including oblique ones, were attempted with little or no improvement in the pattern, from either a practical interpretation point-of-view or a 'simple structure' point-of-view. This first rotation of 45° in AB and AC leaves the factors orthogonal, and therefore statistically independent.

TABLE II.—FACTOR LOADINGS OF ARMA ITEMS AFTER ONE ROTATION. THE FACTORS ARE ORTHOGONAL

Item		Factors				Common
No.	Name	A	B	C	D	Variance
1	Age	.502	.247	.495	.559	.8705
2	Nationality	.516	.148	.410	.240	.5137
3	No. Brothers	.368	.198	.311	.163	.2979
4	No. Sisters	.424	.141	.240	.177	.2886
5	Parental Status	.516	.007	.021	.141	.2866
6	Upbringing	.452	−.028	−.014	.092	.2137
7	Income	.255	.156	.106	.163	.1272
8	Habitus	.099	.339	.290	.332	.3190
9	Reactions	.205	.304	.198	.106	.1849
10	Tension	.092	.643	.198	.573	.7894
11	Tremor	.021	.629	.014	.636	.8008
12	V.M.I.	.071	.537	.014	.566	.6140
13	Achievement	.283	.396	.523	.389	.6618
14	Blood Sports	.283	.184	.276	.269	.2625
15	Artistic	.219	.177	.247	.276	.2165
16	Habits	.134	.191	.184	.134	.1062
17	Alcohol	.382	.113	.205	.269	.2731
18	Tobacco	.262	.134	.141	.071	.1115
19	Gambling	.325	.099	.021	.127	.1320
20	Religion	.452	.057	.339	.177	.3538
21	Religiousness	.304	.163	.113	.127	.1479
22	Marital	.573	.021	.488	.622	.9538
23	Children	.474	.049	.474	.566	.7721
24	Sex Drive	.339	.184	.431	.410	.5026
25	Attitude	.177	.516	.269	.438	.5618
26	Aggression	.191	.445	.184	.283	.3485
27	Personality	.064	.403	.134	.255	.2495
28	Personal Qual.	.233	.587	.509	.283	.7380
29	Family Attitude	.304	.163	.184	.198	.1920
30	Interest in Flying	.297	.354	.431	.346	.5190
31	Passenger Time	.325	.170	.318	.198	.2749
32	Pred. Training	.078	.686	.650	.120	.9136
33	Pred. Combat	.092	.714	.629	.099	.9237
34	Criterion	.226	.354	.452	.141	.4006
	Sum	9.538	9.481	9.485	9.546	

INTERPRETATION OF THE RESULTS

Some of the objectives of this study are not easily reached, regardless of the availability of all existing relevant data. To examine the operations of the human brain as those of a statistical machine, for instance, is not a modest endeavor. Therefore, this study is offered as a limited contribution to our knowledge of the structure and components of psychiatric impressions during interviews. Moreover, certain of the factual results are applicable in the particular setting of these data, viz., the selection of young men for flying training in the Air Force by psychiatric interview.

These factual results are more easily interpreted, so they will be discussed first. It has already been shown[1] that particular psycho-social items are of little value in selecting good flying students, with the possible exception of 'Achievement.'* Experiences of other investigators[3] with similar types of items but in quite different operational settings are in agreement with our findings. Generally speaking, one can reasonably assert that what a person has done is a fair measure of what he can do. A person's age (within physical fitness limits), religion, morality, smoking habits, number of siblings, love of parents, etc. are such weak elements in new achievements that they are easily overwhelmed by elements of motivation and specific abilities.

It is shown in Table I, however, that a psychiatrist can evaluate these various biographical and psycho-social data during an interview and arrive at a relatively high prediction coefficient. On the basis of experience and education, the interviewer subconsciously weights data and summarizes them in his impression, much the same thing that is done in the classical statistical technique of multiple regression. One might well ask how many basic factors are common to the items and the impressions. And further, one might also ask whether those basic factors account for the whole clinical impression. In conversational language, one wants to know whether "the whole is greater than its parts" (i.e., those parts listed). The evidence due to the piecemeal

* 'Nationality' in Table I has as high a validity coefficient as 'Achievement.' Yet the former is not stressed in the text as important because we believe that this finding is peculiar to our sample. All the contribution to χ^2 was due to men of Slavic origin. Moreover, the χ^2 for 'Achievement' is significant at the one per cent level, whereas the χ^2 for 'Nationality' is at the four per cent level, just over the arbitrary boundary.

examination of the types of correlational relationships among items and that due to multiple factor analysis will be discussed next.

The psycho-social and biographical inventory represented by the first thirty-one items of Table I is quite thorough. In attaining such thoroughness one cannot help choosing items which overlap in one way or another. Some items are correlated in the physical world, although one does not know the degree of correlation ahead of time. Such statistically significant associations between items have been termed 'natural relationships between items,' and have been designated by *a* in Table I. The relationship between '24. Sex Drive' and '1. Age' is an example. Some pairs of items are correlated because the variation in one item necessarily (or at least very probably) accompanies variation in the other item. In Table I such cases of statistically significant association have been termed 'systematic relationship between items,' and have been designated by *b*. The relationship between '22. Marital Status' and '23. Number of Children' is an example. Yet other pairs of items are correlated because the meaning of one item implies part of the meaning of the other item. Again in Table I such cases have been termed 'semantic relationship between items,' and have been labelled *c*. The relationship between '10. Tension' and '12. Vaso-Motor Instability' is an example.

Finally, in the case of certain item pairs which lack statistically significant association, the opinion is made that this lack of relationship is interesting. Such cases in Table I are termed 'important lack of association,' and are labelled −. For instance, '2. Nationality' and '32. Prediction for Training' are not correlated, indicating that the psychiatrists did not consider nationality *per se* a determiner of flying ability, whereas the item '2. Nationality' in this sample of flying candidates showed significant association with the criterion; namely, pass-fail in flying training. As pointed out above, if one examines the complete contingency table for '2. Nationality' vs. '34. Criterion,' one finds that only men of Slavic origin made significant contributions to χ^2. Tracing the matter further through complete contingency tables, it is found that the psychiatrists discounted nationality *per se*, but counted the emotional stability of the subject, i.e., '10. Tension,' '11. Tremor,' and '12. Vaso-Motor

Instability'; and that men of Slavic origin in this sample (no generality implied!) of candidates for flying training showed deviations toward emotional instability as shown in their contributions to χ^2 in items 10 and 12.

Admittedly, the judgment of the type of relationship in the case of each item-pair is personal and somewhat arbitrary. However, this reduction of the number of different matters to comprehend in the perusal of Table I is helpful in arriving at simple but useful specific and general conclusions. One such specific conclusion is exhibited in the above paragraph. Other specific conclusions can be gleaned from the individual contingency tables. Reproduction of the five hundred sixty-one contingency tables here is prohibitive, although a psychiatrist interested in the factual elements of this study would find the scrutiny of these contingency tables worth while. Without the evidence of these tables, then, a few more specific conclusions will be given.

Within the age limits of Air Corps volunteers among inductees, age was not a factor in flying ability insofar as '1. Age' was not associated with '34. Criterion.' Moreover, the flight surgeons did not believe that age *per se* was a factor. Age is systematically associated with achievement (it takes time to achieve something), marital status, sexual drive, and passenger time. Yet, some of these items are valid. Apparently, interviewers isolated age as an unimportant factor in these items.

Even brief examination of Table I reveals a complex of items associated with the clinical predictions; viz., '8. Habitus,' '9. Reactions,' '10. Tension,' '11. Tremor,' '12. Vaso-Motor Instability,' '25. Attitude,' '26. Aggression,' '27. Personality,' and '28. Personal Qualities.' None of these items alone was strong enough to reach statistical significance. Yet, this complex allowed interviewers to extract the relevance of many items, otherwise irrelevant.

Painstaking coefficient by coefficient subjective analysis has provided some insight into the nature of psychiatric impressions in this type of setting. By educational training and by intuition (percentage admixture unknown) the interviewer seems to extract certain elementary relevancies or basic factors from the multifarious continuous and discrete sensory data offered him during the interview. He is seldom conscious (how fortunate!) of this factorization; his decision flows from some general impres-

sion of certainty in his choice among alternatives. It is not even known whether factorization occurs at some other level of the nervous system. Factorization may be a schematic fiction, poorly suited as a model for Gestalt intellectual processes. Perhaps continuous recognition in time-space-sensory data 'space' is more germane.

Assuming for the rest of this discussion that factorization is an appropriate symbolic model, one can compare brain factorization with statistical factorization. Any of a variety of systems of factor analysis can be chosen for this purpose. Here, the technique of multiple factor analysis of Thurstone[2] was applied to find the factors common to the thirty-four items. Four independent factors, A, B, C and D, were found to account for all the common variance ('communality') of the thirty-four items. The factor loadings in Table II indicate how much of each factor is in each item. In the absence of an estimate of the sampling error of factor loadings, we arbitrarily chose .30 or above as a significant loading.

Table II seen with this point-of-view suggests names of A, B, C and D. Factor A is the 'Age coefficient'—the element in those items which takes time to develop, as marital status and passenger time in commercial aircraft. Factor B is 'Poise at interview'—the aggregate of those things which convey a 'good impression' during the interview, posture and body build, reaction time, emotional stability, attitude, and others. Factor C is 'Achievement'—how the person has been able to get along in the world, as scholarship, successful married life, social acceptance, sexual adjustment. Factor D is an 'Artifact'—an apparently nonsense conglomeration, perhaps a result of sampling errors in factor loadings in this not-large sample (N = 389).

Factors A, B, and C correspond quite well to the factors of age, tension-tremor-aggression-complex, and achievement, uncovered in the coefficient by coefficient analysis of previous paragraphs which, in a way, was a crude factor analysis. Factor loadings in Table II show that A, 'Age coefficient,' contributed a fair share to items in general (Sum 9.538), but little to the psychiatric impressions (No. 32 .078; No. 33 .092) and little to the ability of learning to fly (No. 34 .226). Factor B, 'Poise at interview,' contributed a similar amount to all items taken together (Sum 9.481), and was important as a factor in flying training both in

the opinion of interviewers (No. 32 .686; and No. 33 .714) and in actuality (No. 34 .354). Factor C, 'Achievement,' likewise contributed broadly to the variegated items (Sum 9.485), and likewise was important in opinion (No. 32 .650; No. 33 .629) and in fact (No. 34 .452).

Other interesting inferences can be drawn from the multiple factor analysis. For instance, the four isolated factors common to all items account for most of the variance in the clinical impression (No. 32 .9136; No. 33 .9237). This communality is of the same order of magnitude as the reliability of these clinical impressions, based on data from repeated interviews by the same and alternate interviewers on the same subjects. Thus, one could infer that in this case the clinical impression is 'a whole equal to the sum of its parts' (i.e. those listed). Moreover, no factor emerged which was common only to the clinical impression and the criterion. Such a doublet might have arisen had the interviewer had some sort of super-sensory insight into the factors important in flying not otherwise sampled by the existing items. Suppose one must know the command 'Open Sesame' in order to make an airplane fly, but one is not taught this command in flying training. The interviewer who determines the knowledge of this command in the subject has such insight as to produce a factor doublet in the item list under discussion. Finally, the small communality of the criterion (No. 34 .4006) implies the existence of further factors in the ability to learn to fly which are not present in all the other items nor in the clinical impressions.

SUMMARY

A multiple factor analysis was performed on the interassociation matrix of thirty-one biographical-psycho-social items, psychiatric impressions, and a pass-fail criterion in a sample of three hundred eighty-nine flying cadets. Four orthogonal factors emerged: A 'Age coefficient,' B 'Poise at interview,' C 'Achievement,' D 'Artifact.' Only Factors B and C were important in the psychiatric impressions and in the criterion, and accounted for almost all of the common variance between these two variables. All reliable variance of the psychiatric impressions was attributable to these isolated factors, indicating (not proving) that in this case the clinical impressions were 'wholes equal to the sum of their parts.'

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PREDICTING SUCCESS OF ENGINEERING STUDENTS

RALPH F. BERDIE and NANCY A. SUTTER

Student Counseling Bureau
Office of the Dean of Students
University of Minnesota

Of all students graduating from high school, roughly one-fifth are seriously considering entering occupations involving scientific and technical training. Many of these students are trying to decide whether or not they should attempt to become engineers. Of a random sample consisting of five hundred men who came to the Student Counseling Bureau of the University of Minnesota for counseling, one hundred sixteen or twenty-three per cent were contemplating engineering as a career, and eighty-nine of these already were matriculated in the Institute of Technology.

In order to provide students with relevant information about their chances for success or failure in engineering training, high-school and college counselors, administrators, and teachers must have available predictive indices of known accuracy and of contemporary value.

The purpose of the study here reported was to evaluate a battery of tests assembled to assist in the prediction of academic success for students considering engineering training as one of their educational alternatives.

Several previous prediction studies for engineering students have been reported.[1,2,3,4] These studies have been of value in the counseling of students, but in light of the increasing and perhaps changing enrollment in technical schools and with concurrent curricular and professional developments, a re-appraisal of the predictive techniques should be conducted.

METHOD

In the fall quarter of 1947, a total of 1,019 freshmen were enrolled in the Institute of Technology of the University of Minnesota. During the first week of the fall quarter, all first-quarter freshmen were supposed to take a battery of tests which included:

Coöperative General Achievement Test, Part III, A Survey Test in Mathematics, Form P

Coöperative Chemistry Test, Form Q

USAFI Tests of General Educational Development, College Level, Test III, Interpretation of Reading Materials in the Natural Sciences, Form B

Revised Minnesota Paper Form Board, Series M.A.

Scores on the American Council on Education Psychological Examination, College Form, 1937 edition, and on the Coöperative English Test, Form OM, were also available for most of these students, as was the student's percentile rank in his high-school graduating class. College grades for the first quarter and for the first year were available and honor-point ratios were based on these grades.

From the five hundred twenty-four first-quarter freshmen who were tested, complete data at the end of the first quarter were avaliable for three hundred one students. The remaining two hundred twenty-three students were excluded because they had left college before the end of the quarter, they had not completed their tests, their records showed transfer credits from other colleges, or after the first week of the quarter, they had decided not to choose a major in the Institute of Technology.

Students in the Institute of Technology select their major from curricula which provide sixteen major sequences. The number of freshmen in these major groups varies. The courses these students take during their freshman year, however, are the same with one exception. Chemistry majors and chemical engineering majors take inorganic chemistry 9-10-12. All other freshmen, if they have had chemistry in high school, take inorganic chemistry 4-5-11, and if they have not had chemistry in high school, take inorganic chemistry 1-2-11.

Before students in the different major groups could be combined, the means and variances for each of the groups were compared on the basis of high-school percentile rank, American Council Examination score, and first-quarter honor-point ratio. On the basis of the consistency of the observed differences, for further analysis the group of three hundred one was divided into:

Group I—majors in chemistry and chemical engineering, all of whom had chemistry in high school. $N = 65$.

Group II—all other majors who had chemistry in high school. $N = 189$.

Group III—all other majors who did not have chemistry in high school. $N = 47$.

For each of these three groups, correlations were computed between test scores and first-quarter honor-point ratio. Multiple correlations and prediction equations were then computed and measures of statistical significance obtained.

This first part of the study was completed after the end of the fall quarter. At the end of the freshman year, a second analysis was made, based on three hundred seventy-two students. Included in this group were seventy-six cases not included in the first analysis and omitted were five who had previously been included. Not all of the tests included in the first analysis were included in the second, those tests which had no or little predictive power for fall-quarter honor-point ratio being omitted from the latter analysis. The additional cases were those students who had taken all of the tests included in the latter analysis but who had been omitted during the first analysis because some of the tests used then were not available. In the case of sixty students who had left school before the end of the year, all the grades obtained up to the time of their leaving were used in determining honor-point ratios. Of these sixty students, twenty-nine left during the first quarter, twenty-five during the second quarter, and six during the third quarter. These sixty students had mean high-school percentile ranks and honor-point ratios which were significantly lower than those for the students who remained in school. The differences between means of the two groups on the G.E.D. Test, the mathematics test, and the Paper Form Board were not significantly different.

This group of three hundred seventy-two students was treated as a whole and not broken into the curricular groups as had been done in the first analysis.

For this group, correlations were computed between first-year honor-point ratio and high-school percentile rank, Coöperative Mathematics Test, G.E.D. Test III, and the Paper Form Board. Multiple correlation coefficients and regression equations were then obtained and the significance of the beta coefficients determined. Correlations were also computed between specific test scores and grade averages in mathematics, chemistry, and drawing, for all those students for whom both the grades in

each of these areas and the scores on each of these tests were available.

RESULTS

The zero order correlation coefficients between the variables, as determined at the end of the fall quarter, are presented in Table 1. These were utilized in determining the multiple correlation coefficients between all the tests and honor-point ratios for each of the three groups. These multiple coefficients were:

Group I .79 Group II .66 Group III .66

All three multiple correlation coefficients were significant at the one per cent level of probability. The beta coefficients for each variable were then tested for significance and the significant ones found to be:

Group I—High-school rank significant at one per cent level
G.E.D. III significant at five per cent level

Group II—High-school rank significant at one per cent level
G.E.D. III significant at one per cent level, Coöperative Math. significant at one per cent level, Paper Form Board significant at five per cent level

Group III—High-school rank significant at one per cent level, G.E.D. III significant at five per cent level

For each of these groups, these variables, with the exception of the Paper Form Board, were re-combined and the following regression equations obtained:

Group I

$$Y_e = -1.0488 + .0179X_1 + .0144X_2 \qquad R_{Y_e}X_1X_2 = .74$$

Group II

$$Y_e = -1.7211 + .0131X_1 + .0137X_2 + .0249X_3 \qquad R_{Y_e}X_1X_2X_3 = .64$$

Group III

$$Y_e = -.9939 + .0132X_1 + .0245X_2 \qquad R_{Y_e}X_1X_2 = .56$$

Y_e = fall-quarter HPR; X_1 = HSR; X_2 = GED; and X_3 = Coöp. Math.

The multiple R's and the beta coefficients were all significant at the one per cent level of probability.

The zero order correlations between the variables as determined at the end of the first year are presented in Table 2.

TABLE 1.—INTERCORRELATIONS BETWEEN TEST SCORES AND FALL-QUARTER HONOR-POINT RATIOS FOR EACH OF THE THREE GROUPS

Group I (chemistry and chemical engineering majors) N = 65

	HPR	HSR	GED	Math	Eng	Chem	ACE	PFB
Mean	1.30	80.31	54.55	52.38	182.92	41.63	98.19	49.89
SD	.71	16.32	11.85	8.41	41.59	13.68	23.04	6.72
HPR		.63	.60	.59	.49	.50	.53	.17
HSR			.40	.41	.38	.26	.47	−.02
GED				.52	.47	.48	.60	.22
Math					.51	.49	.64	.27
Eng						.41	.69	.20
Chem							.33	.20
ACE								.26

Group II (other majors with high-school chemistry) N = 189

	HPR	HSR	GED	Math	Eng	Chem	ACE	PFB
Mean	1.19	75.76	50.33	49.64	163.43	31.37	88.05	49.40
SD	.69	17.78	11.67	7.53	38.12	11.06	23.22	7.04
HPR		.50	.47	.48	.30	.33	.30	.29
HSR			.34	.32	.36	.28	.37	.13
GED				.45	.45	.43	.60	.34
Math					.49	.33	.50	.29
Eng						.32	.65	.27
Chem							.33	.07
ACE								.28

Group III (other majors without high-school chemistry) N = 47

	HPR	HSR	GED	Math	Eng	Chem	ACE	PFB
Mean	1.03	65.19	47.46	49.78	165.72	14.49	85.56	50.54
SD	.78	22.37	10.79	6.65	45.35	7.33	25.20	6.44
HPR		.45	.42	.34	.25	.22	.21	.21
HSR			.21	.31	.35	−.13	.37	.03
GED				.31	.42	.26	.48	−.06
Math					.33	.08	.31	.24
Eng						.02	.80	−.05
Chem							.20	.10
ACE								.01

SD = standard deviation
HPR = total honor point ratio at end of fall quarter
HSR = high school percentile rank
GED = General Educational Development Test III
Math = Cooperative Mathematics Test
Eng = Cooperative English Test
Chem = Cooperative Chemistry Test
ACE = American Council Psychological Examination

TABLE 2.—INTERCORRELATIONS BETWEEN TEST SCORES AND FIRST-YEAR HONOR-POINT RATIOS $N = 372$

	HPR	HSR	GED	Math	PFB
Mean	1.15	75.11	50.59	49.80	49.67
SD	.67	18.89	11.62	7.64	6.95
HPR		.50	.46	.41	.23
HSR			.33	.27	.10
GED				.43	.23
Math					.29

Multiple correlation coefficients were computed for several combinations of variables.

$$R_{Y_e X_1 X_2 X_3 X_4} = .63$$
$$R_{Y_e X_1 X_2 X_3} = .62$$
$$R_{Y_e X_1 X_2} = .59$$
$$R_{Y_e X_1 X_3 X_4} = .59$$
$$R_{Y_e X_1 X_3} = .58$$
$$R_{Y_e X_1 X_4} = .53$$

where Y_e = first year honor point ratio
X_1 = high school percentile rank
X_2 = GED Test III
X_3 = Coöperative Mathematics Test
X_4 = Paper Form Board

The regression equation resulting from the best combination of variables was computed and both the multiple correlation coefficient and the beta coefficients found significant at the one per cent level of probability.

$$Y_e = -.83785 + .01289X_1 + .01410X_2 + .01839X_3$$

Correlations between scores on separate tests and first-year grades in special areas were:

Mathematics grades with Coöperative Mathematics Test,

$$r = .43,\ N = 410$$

Chemistry grades with Coöperative Chemistry Test,

$$r = .42,\ N = 411$$

Engineering Drawing grades with Paper Form Board,

$$r = .35,\ N = 404$$

CONCLUSIONS

As has been found in previous studies, the best single predictor of over-all grade average in college was here found to be rank in high-school graduating class. This was true for three separate groups in terms of first-quarter grades and for the total group in terms of first-year grades. An almost equally efficient predictor is provided by the General Educational Development Test which predicts honor-point ratio in each group almost as well as high-school rank does. In each case, these two predictors, high-school rank and G.E.D. Test, were included in the optimal prediction battery.

In two cases, that of the fall-quarter honor-point ratio predictions for chemistry and chemical engineering majors and that of the first-year honor-point ratio prediction for the entire group, the Coöperative Mathematics Test contributed to the prediction sufficiently to warrant its inclusion in the battery.

The variables included in this study do not provide predictions of greater accuracy than those which have been reported in the past. With the exception of the G.E.D. Test, the types of tests here used are similar to those used in the past. More accurate predictions might be obtained by using additional types of tests—tests of aptitude, interest, and personality. As an effort in this direction, the freshmen entering the Institute of Technology in the fall of 1948 were given the Differential Aptitude Tests, and the results obtained with these will be reported soon.

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BOOK REVIEWS

HUBERT SORENSON. *Psychology in Education.* Second Edition. New York: McGraw-Hill Book Co., 1948, pp. 535.

"Much of the first edition has been completely rewritten, some material omitted entirely, and new material added. The remainder, with the exception of a few pages, has been carefully revised. A chapter on mental health of the teacher and one on basic motives have been added." The basic plan of the second edition and apparently the author's conception of the purpose and function of educational psychology are essentially the same as the first edition.

The book contains an abundance of experimental material and is clearly and interestingly written. For these reasons it should appeal both to instructors and students. It is written more or less from the standpoint of traditional educational psychology texts; but from this standpoint it is quite up to date. It should appeal especially to instructors who take this approach to the subject. It is definitely superior to most books of its kind. It may prove not to make so strong an appeal to instructors who like the child development frame of reference and approach the subject from that angle.

The twenty-two chapters are distributed as follows: three, to physical, mental and social growth; four, to motivational and adjustive aspects of the subject; four, to intelligence—its measurement and correlates; six, to traditional topics of learning and memory, including individual differences, motivation, transfer and theory; one, to work and fatigue; two, to teaching methods and study skills; and two to measuring and reporting educational progress.

J. B. STROUD
State University of Iowa

HELEN SHACTER. *How Personalities Grow.* Bloomington, Ill.: McKnight and McKnight, 1949, pp. 256.

The great appeal of an earlier book designed to foster more adequate adjustment of persons at the high school age led to the present treatise. The older book has been radically revised, concepts added and new material incorporated. The discussions

are no longer limited to a particular age group. They apply to adults as well as to adolescents.

The introductory material is concerned with personality patterns and likenesses and differences among personalities. This is followed by explanations of various social and sexual needs such as desire for approval, for success and the like. After noting how we frequently fail to satisfy needs and the resulting frustrations, various techniques employed for evading rather than for solving problems are explained. These include rationalization, retreat from reality, aggressive behavior, illness and others. The book ends on the theme that successful living is social living. Procedures by which one may come to understand the bases of difficulties in adjustment are outlined and suggestions given for more adequately playing the game of living.

This book, since it is planned for the individual in the general population rather than for the professional worker, is necessarily elementary. It is written in a clear and interesting style, is well organized and can be of great help to those at high school and young adult ages. Furthermore, parents and school counselors will find it very helpful in dealing with older children. It seems to the reviewer that the material is somewhat better for understanding behavior patterns in relation to personality adjustment than in furnishing hints for the readjustments needed.

MILES A. TINKER

University of Minnesota